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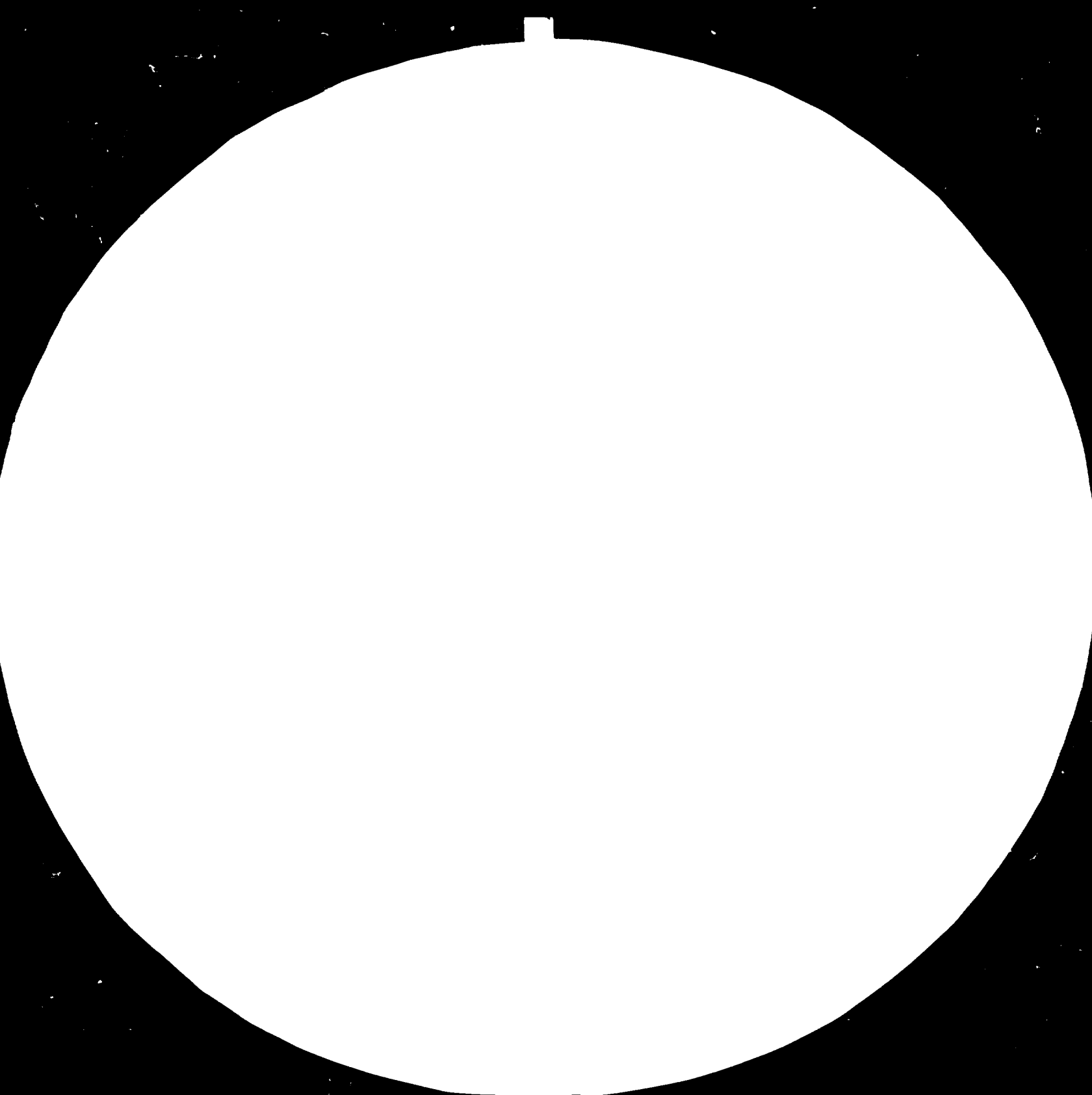

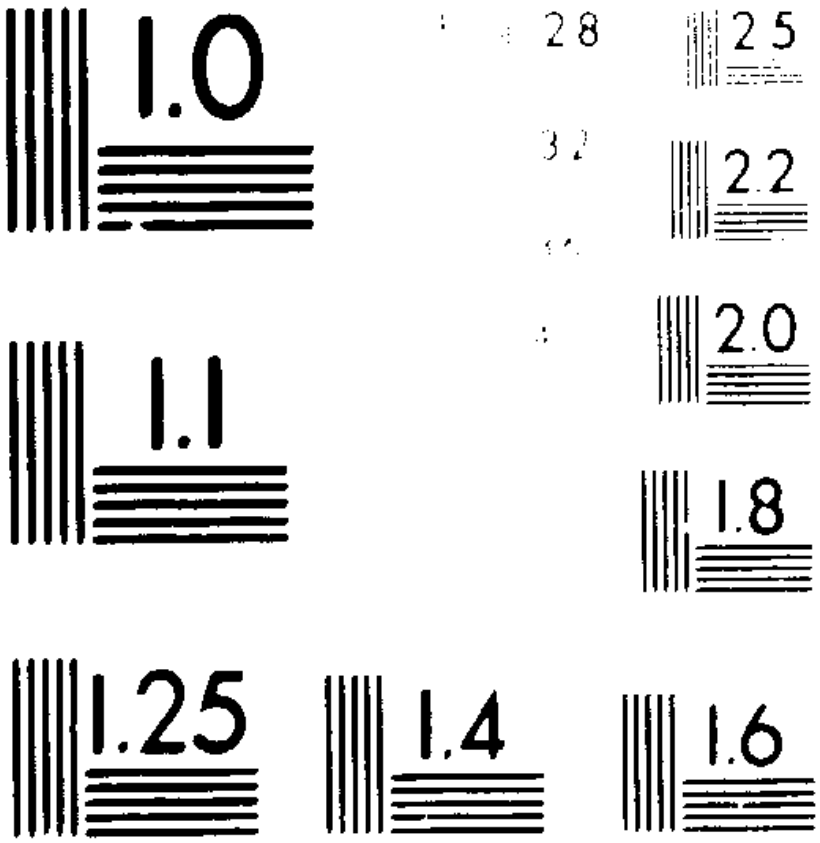

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SOFRECO

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SOFRECO

13160
(1 of 2)

UNIDO PROJECT N° DP/RAF/77/020

CODE DP/RAF/31.6

Niger and Nigeria.

PREFEASIBILITY STUDY

MILLET AND SORGHUM MILL

PRODUCTION UNIT

VOLUME I

CONTENTS (VOLUME I)

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I. EXECUTION MEMORANDUM

1. ENVIRONMENT AND PROJECT HISTORY :

The developer of this project is the United Nations Organization for Industrial Development (UNIDO), the Headquarters of which are located in VIENNA (Austria).

- VIENNA INTERNATIONAL CENTRE
  P. O. Box 300
  A - 1400 VIENNA

The study is financed by the PNUD, within the scope of a program, realized by the ONUDI, of assistance to the Nigeria-Niger Joint Commission for Cooperation, the headquarters of which are located in NIAMEY, in Niger. Its destination is to define, starting from a type of millet and sorghum mill used by village populations, the production unit for these appliances, the setting up of which could be either in Niger or in Nigeria.

The firm SOFRECO, Société Française de Réalisations d'Etudes et de Conseil, with head office in Paris, 9, rue Alfred de Vigny 75008 PARIS, has been assigned this study by the UNIDO; this study took place partly in the countries concerned, partly in Paris.

The field mission took place in two separate stages, one in Niger, from October 14th to November 2nd, and the other in Nigeria, from November 29th to December 20th (see appended reports and maps in the appendix to the present study).

The team which worked on this study in Niger and Nigeria, included :

- Ramon ARESTE — Project Manager
- Marc VENE — Expert in Agronomy
- Gérard BAUMANN — Expert in grain processing

Finally, the SOFRECO team, which in these two countries, received a precious assistance which helped it in the realization of mission, that it be from UNIDO or local political and administrative authorities, or from the different Ministries or Organizations the names of which figure in the appended reports.

We want to thank them very sincerely, especially MM Gabriel AKUNWAFOR General Secretary, Boureima MAGAGI, Deputy General Secretary, and GADO, Financial Manager of the Joint Commission both for their collaboration and their assistance all along our mission.

A "Prospective study for the Agricultural Development of the SAHEL zone 1975-1990" has been published by the FAO in 1976. Later, were published the CILSS and SAHEL Club works presented in 1977 at the OTTAWA Conference, conference to which was also referred the "MAIDUGURY PROJECT", developed by the IDRC (Industrial Development Research Centre) of Canada.

Afterwards, followed one another at short intervals :

- A new IDRC study, at PITSANE, and then at GABANE, in BOTSWANA (1977-1979).
- The UNICEF study "Village Technologies in western and central Africa (1977-1978).
- The IDRC report at NAIROBI (1978) on Millet and Sorghum.
- The DAVES and ELTERICH report at the "Conseil de L'Entente" (1978).
- The OECD-SAHEL Club study "Critical evaluation of Food Assistance (Aide Alimentaire) in the SAHEL, presented at the NOUAKCHOTT Symposium. (1979).
- The studies undertaken in many laboratories, mainly the one of the IRAT (Institute for Tropical Agronomic Research, in Montpellier).
- The MARPLAN-TOPFER Institute report on the creation of millet and sorghum processing unit (1982).

More recently yet were published :

- The SCET-AGRI report on "Traditional grain technologies in the SAHEL countries. Its part in food self-sufficiency published by the French Ministry of Cooperation and Development (April 1982).

- The "Ecole Nationale du Génie Rural, des Eaux et Forêts Students' report, "The Niger agricultural environment : which processing for millet and sorghum . (March 1982).

- 4 UNCC studies on millet mills and grain banks. (1981 and 1982).

Running through all these documentations and many other which can be seen at the CEEMAT (Centre d'Etudes et d'Expérimentation du Machinisme Agricole) and at the GRET (Groupe de Recherches et d'Echanges Technologiques), or which have been published as review articles (in "Agronomie Tropicale" - 1966 - N° 8 - 1967 - N° 8 - 1970 - N° 1 - 1971 N° 10 in "Annales de la Nutrition et de l'Alimentation" - 1963 - N°3), it can be noticed that the industrial processing of millet and sorghum cannot exclude, before a long period, the cottage industry processing, in village mills.

The craftsmen's mechanization is considered as necessary to free women from their daily and most tedious chores, and from then on, to free them for other tastes, somme more enriching on the human and social plans, and other which could contribute to the food self-sufficiency policy.

2. MARKET AND PLANT SIZES :

The yearly requirements for mills have been estimated at about 700 appliances for Niger and about 3.800 for Nigeria, and the yearly demand, respectively for each of these countries at about 320 and 1700, i.e. a yearly total of 2.020 appliances.

For the dehullers, the demand has been figured at approximately 600 appliances a year, for the reasons exposed in chapter III. Finally, the annual production program for the plant has been set at :

mills	2031	
dehullers	612	
spare parts	225	(in mill and dehullers equivalent)

i.e. a total of 2.868 appliances for a production capacity for the plant under study of approximately 5.000 appliances.

This production capacity has been computed on a 230 work days yearly basis, with a crew defined in chapter VIII working 8 hours a day.

3. MATERIALS AND PRODUCTION FACTORS :

The appliances we recommend present the essential characteristic that their bodies are made in welded steel instead of being in cast iron, solution which presents the interest of limiting at the utmost the imports of finished products, and therefore of bringing locally the maximum of added value, starting from imported basic products (see in annex conception, welded steel body of the CHAMPENOIS appliance, type V 300 and V 400).

4. LOCATION :

From the missions realized in the departments and states of the concerned two countries, we are lead to think that the best location for the plant could be :

- for NIGER : the region of BIRNI-N'KONI, MARADI
- for NIGERIA : the region of GUSAU, KATSINA, KANO

These locations take into consideration the constraints of this type of industrial unit, and the fact that we recommend, in a first stage, the construction of a single unit.

The definite siting could however not come out of the mission we were assigned; however, for NIGER, this siting could be set, after a careful study, in the industrial area of the city of MARADI, either on an inoccupied plot, or by the re-use of the closed-down plant of CFDT (see plan N° 3 in appendix).

5. PROJECT TECHNICAL ASPECTS :

The plant will build mills; it will be the basic appliance which the population should be able to obtain, in a first stage. At the same time, some dehullers could be built, the type of which could be set definively after study of different models. This study could be undertaken by the Engineering Department of the AHMADU BELLO UNIVERSITY (A.B.U.) in the town of ZARIA (NIGERIA).

Finally, later on, this plant could build millet and sorghum shellers and water pumps.

The mill to be built is one of the vertical metal plates type, with an fourly mean output (depending on the product) of 200 kg/h.

The dehuller could either be one of the IDRC Mini-dehuller type, which can process a load of 5 kg of product at one time, or the IDRC PRC/R11C type, which can process 10 kg at one time, or both types.

The production unit would occupy a land area of 1.050 m^2 and could be set on a 5.000 m^2 plot, in order to allow further extensions; anyhow, the production unit as defined in this study will have a production of about 43 % of its equipment maximum capacity; on the other hand, it will be practically possible to double the capacity of the machine workshop without building extension, on account of available space (see in annex - plan N° 1).

Civil engineering and public works will include the fitting out of the plot; the scraping, resurfacing and compaction of the building land; the building foundations will be of shallow foundation type, or isolated, continuous foundation slab, depending on situation. The machines and equipments will be set on independant concret mast.

The construction will be simple, with metal frames either braced framework or solid state beam's type, of local construction; the walls will be made up of hollow breeze-blocks up to a height of 3,5 m and in aluminum coating for the rest.

The roof will be in aluminum sheet and in translucent polyvinyl for the lighting parts.

6. MANPOWER :

The total personnel will be 56 persons, split in 15 administrative and commercial employees and 41 in the workshop.

The staff, normally of 5 nationals will be reinforced for the first two years of operation by 3 expatriates, indispensable at the key posts, that is at the levels of plant management, supplies and workshops. These expatriates executives will have for mission to train their Nigeria, or Niger counterparts, to implement and to run in the technical production and management structures. We believe that a 2 years period is a minimum, if the project is to become viable, and that takes into account the locally available manpower.

The Plant Manager should be a good administrator and a good technician. Therefore, he should have received a basic technical education.

Regarding social security contributions, while it has been fairly easy to estimate them in Niger, that has however been very difficult in Nigeria, where all employers and officials we met were very discreet on the percentage of mark-up on salaries which should be applied; we consider that the level of 20 % of salaries which we finally retained represents a maximum for both countries, especially for Niger where the amount is of about 17 %.

7. IMPLEMENTATION SCHEDULE :

We have reckoned 17 Months between the beginning of the studies and the end of the tests of the plant before its operational start.

This period of time includes 5 months in 1983 for the studies, the preparation of the invitations to tender, and one year, in 1984, for the construction, the setting up of the machinery and equipments and the tests up to the reception of the plant.

The plant's getting into production would occur early in 1985, 1985 being a period of running in at 50 % of expected production, and the year 1986 being the first year of production at the level expected in the study.

8. FINANCIAL AND ECONOMIC EVALUATION :

The total cost of initial investments is estimated at 560,1 millions CFA Francs for a plant located in Niger, and 1.140.226 Naira (₦) for a location in Nigeria.

The break-up of these prices is the following :

	NIGER (CFA)	NIGERIA (₦)
Fixe investments	265.303.000	540.494
Pre-production capital expenditure	90.348.000	190.335
Net working capital (full production)	204.504.000	409.397
Total investment cost	560.155.000	1.140.226

The financing requirements are estimated respectively for Niger and Nigeria at 440.000.000 CFA and at ₦ 880.000. The financi will be brought for 25 % by the capital, paid in 1983 and 1 and by medium term credit, on 9 years, for the remaining 75 % . ich gives :

	NIGER (CFA)	NIGERIA (₦)
Financing by developer	110.000.000	220.000
Financing by MT credit	330.000.000	660.000
TOTAL financing	440.000.000	880.000

The medium term 6 years would be respectively at 16 % and 8 %, with reimbursements starting after 2 years. The Nigerian rate of 8 % should be accompanied by a Commitment Commission of 1% a year. The first payment of interest would take place in 1986 (see schedule of payments and reimbursements, capital + interests at chapter 10).

The actuarial rates come out at 12,73 % and 6,93 %.

The production cost at cruising speed are the following for each of the countries.

	NIGER (CFA)	NIGERIA (N)
Production costs	435.481.000	897.004
Overhead	5.222.000	11.462
Costs of sales and distribution	50.478.000	100.956
Subtotal operating costs	491.181.000	1.009.422
Financial costs	46.400.000	46.400
Depreciation	32.767.000	63.262
Total cost of production	570.348.000	1.119.084

The financial analysis at the level of the projected balance sheet (figure 10-10) shows a strong progression of the project's reserves, which permits to see that its financial structure is quite good concerning its internal rate of profitability, its calculation in both cases shows that it is of about 29 %. This is very favorable and should allow to obtain credit at the market's levels.

Figures 10-14 give a rate of profitability of shareholders' equity of about 55 %. From such results, the project is financially very interesting, that it be located in one or the other of the two countries.

9. CONCLUSION :

As a conclusion, we can say that the project will contribute to the regional economies development for both countries. Its local establishment will have an important impact on the rural population on account of the structures and the products which it will make available for it.

It will be possible to adapt completely the marketed products to the users' requirements. At the present time, this is unfortunately not the case. For instance, the ENGLEBERG type dehullers are not adapted for millet and sorghum, the engines and mills do not match (engines too powerful, or not enough). This results, of course, in bad work, but also in additional costs, at the user's expenses.

The quality of the marketed products should be higher, and their work life should be longer, the spare parts would be rapidly available, while at present, it is necessary, in some cases, to wait a few months which keeps the mill from being operative, or lenghtens its operation with a faulty work, or even, in some cases, with conditions dangerous for the operating personnel.

The project should play an important part for what concerns the users' training, through the after-sales service and the other plant services which will do what is needed for the realization of correct installations, the maintenance and the quick repairing of the appliances. The training of qualified millers is essential for the use and the preventive maintenance of the mills. The project will allow giving such a training in the plant. Finally, the production unit will allow the training of personnel qualified in mechanics and boiler making. These workers, leaving the plant, could play the same part as the one played at the present time through the centres of ACREMA type in Niger.

Besides the private sector, the diffusion of mills in the rural environment as well as their management should imperatively rest on the actual structures and those to come of organisms such as :

- UNCC - AFN - ANIMATION in Niger.
- The Ministries in charge in each state of NIgeria of the development of cooperatives.
- The Ministries in charge in each state of Nigeria of the development of small industries.

II. ENVIRONMENT AND PROJECT HISTORY

- Environment and project history

- Developer and originator of project

- Cost of preinvestment and preliminary studies (exhibits 2 ER and 2 IA)

ENVIRONMENT AND PROJECT HISTORY :

The RAF/77/020 programme "Assistance to the Nigeria Niger Joint Commission for Cooperation" entrusted to UNIDO in association with FAO due to extend from June 1979 to June 1982 had the target of preparing, evaluating and realizing projects, adapted to local conditions for the processing of products generally perishable, or feasibility studies in agribusiness industries.

In January 1980, the MARPLAN TOPFER INSTITUTE turned out a general prefeasibility study, concerning among others the millet and sorghum processing.

This study RAF/77/801 brought to the fore among others an increasing tendency for the replacement, in rural environment, of the milling of millet and sorghum with mortar and pestle by processing with mechanical mills.

Through this mechanization, women can avoid a back-breaking chore thanks to simple mechanical installations. The material should allow to process all a range of goods (millet, sorghum, groundnuts, niebe-beans, etc...) but also some products more or less fermented for the preparation of the different traditional dishes.

In order to judge of the scope of this problem, it should be known that the rural populations concerned in Niger represent about 86 % of the country's total population and about 73 % in Nigeria (for the States directly concerned).

Supplying these rural populations with flour or semolina processed by industrial or semi-industrial mills located in urban centres cannot be contemplated within a short or medium term, on account of the circuits to be established and the increasing costs of transportation.

Moreover, these products could only satisfy partly the habits in matter of food for the concerned populations, who prefer the products more or less fermented. Finally, it should be noted that those industrial type mills do not exist yet, except in the large urban centres.

The purpose of this study is to estimate, starting from the best adapted type of appliance, the needs and demand for such mills, and therefrom to define the unit for the production of the machines to be manufactured for the equipment of Niger and Nigeria.

The systematic equipment of the regions concerned will bring them, while starting a semi-industrial activity, a greater welfare, this is enjoyed presently only in the cities. At the same time, it will help to maintain population in the rural areas and free women from a tedious work, releasing them for other activities, among which farmwork.

Finally, keeping locally the offals will allow their use for the feeding of livestock.

DEVELOPER AND ORIGINATOR OF PROJECT :

On account of the complexity of the file concerning millet and sorghum milling, it has been broken down in two sections :

a) Lead the study to set up 3 semi-industrial pilot plants. .

b) Elaborate a project tending to the satisfaction of rural needs through the creation of a plant meant to produce cottage industry-type mills and cehullers adapted to the region.

The Nigeria Niger Joint Commission whose headquarters are in NIAMEY, SONORA Building, asked the PNUD to finance this 2nd section, the realization of which being entrusted to ONUDI, in order to perform the study on the creation of such a plant.

The Société Française de Réalisation d'Etudes et de Conseil (SOFRECO) was put in charge of this study, which took place in two steps : in Niger, from October 14th to November 2nd 1982, and in Nigeria from November 29th to December 20th, 19 82.

Charts 2 ER and 2 IA hereafter give the estimates of the cost of related preinvestment and research studies.

This preliminary studies are necessary to complete or (and) to improve certain points of this study; as well as to do research and land studies necessary to the realization of the project.

The preliminary studies costs included the cost of personnel (engineers, surveyor), the related expenses concerning travel, local transportation and accommodation.

EXHIBIT 2 ER

INVESTMENT COST ESTIMATE
PRELIMINARY PREINVESTMENT AND
RESEARCH STUDIES

INVESTMENT COST ESTIMATE IN 000 F CFA			
Preliminary preinvestment and research studies			
NIGER	Cost (000 F CFA)		
DESIGNATION	Foreign currency	Local currency	TOTAL
Preinvestment studies	13.752		13.752
Preliminary research (plot search and study)	1.917	852	2.769
TOTAL	15.669	852	16.521

Nota : The abbreviation ER indicates exhbits relating to Niger or to a Niger project establishment.

EXHIBIT 2

INVESTMENT COST ESTIMATE
PRELIMINARY PREINVESTMENT AND
RESEARCH STUDIES

INVESTMENT COST ESTIMATE IN ₦			
Preliminary preinvestment and research studies			
NIGERIA	Cost in ₦		
DESIGNATION	Foreign currency	Local currency	TOTAL
Preinvestment studies	27.504		27.504
Preliminary research (plot search and study)	4.095	1.819	5.914
TOTAL	31.599	1.819	33.418

Nota : The abbreviation IA indicates exhbits relating to Nigeria or to a Nigeria project establishment.

III. MARKET AND PLANT SIZES

1. Study of existing products
2. Determination of products suited to the needs
3. Estimate of number of existing mills
4. Determination of needs in mills
5. Determination of demand
6. Production programme and plant capacity
7. Exhibits :

   - Production programme exhibit
   - Sales yield estimate (exhibits 3-1 ER/3-1 IA)
   - Estimate of cost of production (exhibits 3-2 ER/3-2 IA)
   - Estimate cost of waste (exhibit 3-4 for the record)

1. STUDY OF EXISTING PRODUCTS :

From our field visits, we have noted the following points :

The term of MILL, often used,concerns in fact two different machines, which each fulfills different functions :

a) the mill which grinds, and gives out a milled product.
b) the dehuller which separates the kernel from its hull.

Mills :

All the mills we have seen were of the vertical metal plates type. We have not run into hammer-mills, except in a semi-industrial plant in BAUCHI. (However, we know that there exist a certain number of them).

These plate-mills are of help to the customers, even though their set-ups leaves much to desire. Actually, their set-ups are faulty, with engines too strong or too weak for the required outputs, rotation-speeds too high, with an effect on the quality of the grist, etc...

The type of products obtained (a mix of coarse and branny semolina and of flour) is closer to the one obtained by pounding, coarser and less fin than the flour obtained in semi-industrial set-ups.

Nevertheless, it is possible to obtain a higher degree of fineness by setting the plates closer to one another and by grinding two or three times the same product in the mill.

Concerning more particularly the components of the mill, the metal plates used are of different diameters according to the models. This diameter, often too small, does not allow an efficient grinding and a correct output with moist products. The bodies of the grinders are in cast iron. In the case of a local appliances manufacturing, they should be imported. This would reduce the production unit to an assembly chain, at least until the creation of a foundry.

Concerning the mill type, we have noted that the one in use allows the production of flour starting from relatively moist grain. For this moisture, which is difficult to control, the screens of a hammer mill risk to be plugged, in the case of a mill equiped for fine milling.

Dehullers :

Whether in Niger or in Nigeria, the ENGLEBERG type dehullers which are used are adapted to rice, but not to millet and sorghum. In Niger, in rural areas, there are no dehullers, except in the NIAMEY department. There is an important need for millet and sorghum dehullers, since, very often, millet and sorghum are dehulled by hand (pounding) before milling. However, in Nigeria, the milling operation is done on un-dehulled millet an sorghum. The dehullers used on millet and sorghum in Niger (only in urban areas) are used in Nigeria only for rice.

These findings are confirmed by the study "Feasibility study on Food Grain Processing in Nigeria (June 1978), which indicates that, in Nigeria, only 19 % of the grain are dehulled before milling.

The products obtained from the machines we have seen undergo abnormal overheating related among others, to excessive rotation speeds and to the maladjustment of the existing machines projected for rice dehulling.

The dehulling by mortar and pestle is considered by the women as a more tedious operation than the milling itself (by pounding). Therefore, there exists, in as much as means for purchase are released in favor of village populations, an important market for dehullers.

It would be interesting, after studies and tests to build a dehuller of the Canadian RIIC/PRL type, which requires less power than those used at present, and which would allow a batch production, by 5 or 10 kg batches. Contacts should be taken with the concerned organization to obtain detailed results of their studies and tests realized in Africa on the same products. This organization is willing to give free of charge the licence for the manufacturing of their dehuller and to give assistance in its mass production.

Grain shellers :

Finally, we have noticed a need in shelling machines. Actually, such machines are not yet used in Niger, and very few in Nigeria.

Engines : (See technical note appended in volume N° 2)

In the centres where electricity is distibuted :

The electrical motor, compared with thermic engines, is better adapted :

- low cost of maintenance
- higher yield
- less nuisances (noise, smell etc...)

- no fuel supply problem; no need to stock it.
- lower purchase price.

In the centres without electricity :

The diesel air cooled engine is desirable.:
. More expensive, but sturdier and less liable to break-downs than the gas engine.

Nota : Motors of three or four power ratings could be offered to satisfy the milling and dehulling outputs corresponding to the users needs level

The requirements in appliances concern the following materials :

- mill
- dehuller
- sheller

However, caution should be taken regarding the determination of the products to manufacture and the production capacity for the plant to be set up. Indeed, considering the financial means of the demand, which are very low, purchases will go first for the mill, thence for the dehuller and at last for the sheller. Consequently, we shall study a unit tending to satisfy first the needs in mills, while producing a small quantity of dehullers, whose launching on the market will permit to test the demand and to adapt the material and its manufacturing to the needs. The same process will be followed for the sheller, but at a stage outside the scope of our study. At last, later on, the manufacturing of small waterpumps could be contemplated, their use going to be increasing.

Proceeding as above, we are certain to have a unit capable to work at full load on one or several products, but only after it will have well assimilated its technique on a mass production basic material.

As far as engines are concerned, their manufacturing can be contemplated locally, only within an engines production unit, for uses other than those of mills. In the meantime, it will be cheaper to import them.

Niger has a population in 1982 of about 5.800.000 inhabitants, among which 5.000.000 Live in rural environment (there are about 9.000 villages) and 800.000 in urban areas (42 centres have been defined as such).

The population growth rate is high, 2,77 % a year, with a very fast urbanization, especially in NIAMEY (see chart N° 1 ER volume 2).

Agricultural activities consist mainly in the cultivation of millet on approximately 3 million hectares, producing about 1.300.000 tons, and sorghum on nearly 900.000 hectares, with a production of about 320.000 tons.

A relative stability in the surfaces under cultivation can be noticed, as well as a relative consistency in yields, on account of the rainfall.

After excepting the irrigated areas, dedicated most often to rice, it can be noticed that in all Niger departments of sahalian climates, inhabited by sedentary population, are grown millet and sorghum. The production of the different zones is directly related to the numbers of the rural population which lives there.

The departments of NIAMEY, MARADI, ZINDER and DOSSO, which have the highest density in villages, produce the highest quantities of millet.

This production goes mostly for the traditional daily food. The population in villages is wholly self-sufficient for food, that in towns almost wholly. It should be noticed that, in the towns, millet and sorghum are more and more supplanted by rice and wheat.

Consumption is estimated at 220 kg a year per person in the rural sedentary areas, at 190 kg in the nomadic areas, and 150 kg in urban areas. On these bases, a quantity of 1.600.000 tons, including offals, should be reached in 1992. Niger should then reach self-sufficiency (consumption + seeds). It should be remembered that the farmer all over the world is a man of caution, who tries to keep a certain stock, in expectation of the risks of the next year.

These quantities of millet and sorghum, besides the part marketed for processing in the industrial mills or returning for traditional consumption are generally stocked in ears, in the village granaries.

It is in function of the needs, generally every day, that the men hand in the number of ears needed to the women, who realize all the processing operations : shelling, hulling, grinding and bolting, with pestle, mortar and winnowing basket, before going to the preparation of the meals (especially the "boule" fura, morning drink and the "paste", tuwo, evening meal).

However, one after the other, have spread craftsmen's mills in some villages and in the boroughs of the cities. Besides the winnowing baskets have appeared metal sieves. Nevertheless, there has not been any thresher or sheller set up in the land.

For Nigeria, we have considered the population for the 8 states principally concerned by the production and consumption of millet and sorghum. They are the following states :

BAUCHI, BORNO, KADUNA, KANO, NIGER, PLATEAU, SOKOTO and KWARA.

For these states, the total population in 1982 is of about 40.167.000 inhabitants for a rural population of about 30.513.000 inhabitants. This rural population should be in 1992 of about

38.107.000 inhabitants, estimate based on a growth rate of 2,5 % a year (see chart 1 IA - volum 2).

Consumption for these states in rural areas, is evaluated at 165 kg a year per person. This quantity results from our own field visits. On a basis of 165 kg, the total rural consumption would reach 8.292.000 tons in 1992. It should be noted that according to the studies (1) (2) the level of average consumption for the 8 states varies between 150 and 159 kg/year/person.

NOTA : (1) MARPLAN Study

(2) Study "Feasibility on Food Grain processing in Nigeria in 1978 ".

2. DETERMINATION OF THE PRODUCTS ADAPTED TO THE NEEDS :

. Mills :

Determination of the hourly output will take into account the following factors :

- The yearly consumption in rural areas per inhabitant varies according to the land between 165 and 220 kgs.

  In our computations, we shall take 200 kg/year/person :

  A mill works, when allowed by socio-economic conditions, for 40 to 50 families, who go daily at the mill to have prepared the quantity of grist corresponding in general to 2 days' consumption (This leads to the conclusion that a mill works, on the basis of 10 persons by family, for 800 to 1.000 persons. These figures have often been confirmed).

- In rural areas, a mill works approximately 4,30 hours a day, since the miller also works in the fields. We shall retain the figure of 4 hours.

  Therefore,a mill should grind between 437 and 547 kgs/day (calculated figures).

  If we take the figures of study (1) which were confirmed in our field study, we shall take a figure between 400 and 500 kgs/day, which is nearer to reality. (If we take 40 to 50 families/day having given for grinding 4 tia/day, we also find 400 to 500 kg/day 1 tia ≃ 2,5 kgs).

The hourly output of the mill will be of 100 to 125 kgs.

This output should be corrected to take into consideration the factor of utilization of the mill.

- The coefficient C 1 is function of the time of work with product to the total time of working with or without product and the time it takes for the mill to stop running, these times are related in particular to :

  - change of customer
  - change of product
  - waiting time in order to have enough product to run, before starting the grinding operations for a rather long period.

The measurements made show that these times vary between 11 and 16 % of the effective time of work. We shall take 15 %, i.e. a coefficient C.1 = 0,85.

- The coefficient C 2, which is function of the product, gives an hourly output different from the output rated by the manufacturer. This coefficient varies according to :

  - the nature and state of the grain to be milled.
  - the grains' moisture
  - the degree of reduction desired for the grinding.

On 9 measurements made, we have found a coefficient varying between 0,44 and 0,96, we have taken the average, which gives :

$$C_2 = 0,66$$

Thence, the coefficient C of use of a mill :

$$C = 0,85 \times 0,66 = 0,56$$

On a basis of 4 hours, the average hourly yield of 100 to 125 kg can be reached only with a mill with a rated output of 178 to 223 kg/h.

We will take a mill with an output of 200 kg/h.

Our study is based on the production of a mill with the above output. This mill will be used as well in the countryside as in the urban areas for a semi-industrial production of flour.

There is in the range of existing mills whose outputs rated by their manufacturers vary according to their types from 180 kg/h to 270 kg/h on dry product and 125 to 227 kg for moist products.

It should be noted that yields vary in function of many factors :

- rotation speed
- available power
- nature and condition of grain processed
- degree of fineness of desired grinding.

Very damp kernels clag the plates and can reduce considerably the mill's output.

We have noticed in Niger and in Nigeria the following points :

- All the mills encountered were of the vertical plates type. These grinders give a service which satisfies their customers, even though their use leaves something to be desired.

  In fact, set-ups are often faulty, mills and their engined are not on the same level, machine-rooms are too small, engines are too strong, or not strong enough for the desired outputs, rotation speeds are too high, with an effect on the outputs and the quality of grinding etc...

The type of product obtained (a mix of coarse semolina and of flour) is nearer the one obtained by pounding, coarser and less fine than the flour obtained in semi-industrial plants. But it is possible to obtain a finer grinding by setting the plates closer to one another and by recycling one or moretimes the same product if necessary.

It can be said that, on account of the large number of this type of mills set-up in these two countries, it does not seem worthwhile to introduce in these countries, through the creation of a production unit, another type of mill which would certainly face competition from legal or illegal imports of the mills to which their users are accustomed. On the other hand,the production of spare parts for the mills in operation and those to come would be an important activity for the industrial unit, therefore, it seems useful to standardize at the utmost the types of spare parts.

As far as the mill is concerned, we have noticed that the type in use gives the possibility of obtaining flour with rather moist grain; a mill with screens would risk being clogged by the same product.

Concerning more particularly the components of the mill, the metal plates used show,in comparison with vitrified bakelite plates with corundum, and in consideration of the product to obtain the following principal advantages :

- more rugged
- easier to manufacture locally (forward there are industrial foundries establishment projects).
- lower cost.

The diameter of the plates should not be below 250 mm, in order to have a grinding without problems with moist products. These plates

should be made in white cast iron, the hardness of which will allow a longer operating life.

In consideration of what we have stated at the beginning of this chapter, we have chosen to manufacture the body of this machine in welded steel. (see in appendix the technical notice of CHAMPENOIS mill).

. Dehullers presently in operation in Niger and Nigeria are dehullers adapted for rice processing but not for millet and sorghum. Therefore, before starting this type of material, it is necessary to be cautious. We recommend to build in small quantities a Canadian dehuller of IDRC type, of which it is possible to obtain detailed plans, and which can be produced without paying royalties (see appended documents).

Observation : The tests undertaken on this type of appliance in BOTSWANA as well as in MALI have shown their superiority over ENGLEBERG type (see FAO study FAO-GCP-RAF-045 August 1981 and June 1982).

In a first stage, we could build the mini-dehuller IDRC type, the output of which seeming well adapted to the rural requirements.

The minimum lead is 5 kg and the hourly output between 60 and 100 kgs, with an engine of 3 HP.

A limited production could easily find buyers; at the same time, tests on this type of material could be led by the ABU University of ZARIA, to determine whether it would be better to build either the above mentioned type or the IDRC PRL/RIIC which works with a minimum lead of 10 kgs, or both types (see appended note concerning engines).

3) Estimate of the number of mills :

Grinders :

It is impossible to know the exact existing number of mills, since no complete representative census has been done up to now. In certain existing statistics, the indicated figures include both mills and dehullers.

The only reliable source in rural environment is the 1981 census realized in the 4 rural arrondissements of the MARADI Department, in NIGER, which indicates 1 mill for 3.500 inhabitants. In this case, the "mills" concern only the grinders, since there are no dehullers in the rural areas, except in the NIAMEY department. At the same time, for the state of KANO In NIGERIA, the 1981 census indicates 1 mill for 2.480 inhabitants. (in the urban centres, the information gathered give 1 Mill for 1.300 inhabitans).

Another possible source of estimate of the number of existing mills may be the number of import licences applications, even though the indicated figures cover as well the grinders as the dehullers. Besides, these figures do not indicate necessarily that all these material have finally been imported. Finally, in these figures, no consideration is given to the number of mills purchased without licence application. In a first stage, it could be considered that those compensate the import licenses applications which were not followed by imports.

NOTA : The number of licences does not indicate the destination of the mills, that they will be for urban or rural areas. Finally, the terms of references indicate that 20 to 30 % of NIGERIA needs in mills are already satisfied.

According to the "Feasibility Study on Food grain Processing in NIGERIA - 1978" it was estimated that in 1975, there were 25.000 mills in NIGERIA.

For NIGER : Between 1976 and 1982, there were 1.632 applications for towns and country. (see appended chart N° 5 ER Source - Ministry of Commerce).

Should the life expectancy of a mill be of 10 years, there remains to estimate the number of machines imported between 1972 and 1976.

If we take the figure found by computation of 2.078 machines in existence now, and supposing that the 1.632 appliances be grinders, there would have been imports of 2.078 - 1.632 = 446 machines imported on the 4 years between 1972 and 1976 i.e. 111 per annum.

This figure should be compared with the 101 import licence applications made in 1976/1977. Even though this figure of 111 seems overestimated, it could be considered as valid, since, in fact, a certain number of machines were already there before 1972, which reduces the yearly average to a figure under 101.

We shall keep in mind as the figure of existing mills the quantity of 1.450.

For NIGERIA : According to the study (2), there were in 1975 for the whole NIGERIA about 25.000 mills, grinders and dehullers. These figures comprise the whole range of mills, from the "pepper grinder "type, of a capacity of about 21 kgs/h to the model with an output of 250 kgs.

According to different sources of information, it can be estimated that needs are satisfied at a level of 30 to 40 % in the 8 states mainly concerned.

Dehullers :

Concerning the dehullers, it can be estimated that there is none in the country-side in NIGER at the present time, and that in NIGERIA, even though a certain number are in operation, those are used rightly, only for the dehulling of rice. In fact, these machines of the LEWIS-GRANT type are adapted to the processing of rice (see document in volume 2 : manufacturer's letter ref. JW/VWC) but not to the processing of millet and sorghum, as we have been able to see.

4. DETERMINATION OF NEEDS IN MILLS :

Needs in grinders :

Through our mission, we have noted that a grinder should work, in rural environment, for 800 to 1.000 persons. We shall keep the figure of 1.000 persons for our computations, which will give a pessimistic figure; on the other hand, if it is considered that grinder should process between 400 and 500 kgs/day of product, i.e. between 146 and 182 tons per annum, we would keep the average figure of 164 T/year.

From the preceding data, we can establish the following chart, using :

- the population figures (see charts 1 ER and 1 IA, appended).
- the consumption figures (see charts 4 ER and 3 IA, appended).

Needs in dehullers :

The needs for NIGER could be estimated at a figure equal to that of the grinders, i.e. 7.200 machines.

For NIGERIA, an estimate of needs is difficult to make, if not altogether impossible, since about 80 % of millet and sorghum are milled in the dry form, without prior dehulling, the elimination of part of the bran being in some cases done by winnowing.

Therefore, it is not possible to know what influence on the food habits could have the existence on the market of a well-adapted dehuller. Needs could vary between 8.000 and 38.000 machines.

SUM UP OF NUMBER OF EXISTING MILLS

	NIGER		NIGERIA	
	Inhabitants	Number of mills	Inhabitants	Number of mills
1st approach :				
- Rural population 1982 :	5.002.000		29.770.000	
a) Hypothesis :				
- 1 mill for 3.500 inhabitants in NIGER				
- 1 mill for 2.400 inhabitants in NIGERIA		1.429		12.404
- Urban population : 1982 :	(843.000)		(10.697.000)	
b) Hypothesis :				
- 1 mill for 1.300 inhabitants		(649)		(8.228)
Total (a + b)		2.078		20.632
Existing number of mills (figure considered for rural areas)		1.430		12.400

CHART OF NEEDS IN MILLS

DESIGNATION	NIGER		NIGERIA	
		Number of mills		Number of mills
1 According to hypothesis 1 Mill/1000 inhabitant				
Population 1992	6.196.000	6.196	38.107.000	38.107
(1 mill/800 inhabitants)		(7.745)		(47.633)
2.According to consumption hypothesis				
Millet and sorghum consumption	1.336.000 T	8.146	6.288.000T	38.341
TOTAL number of mills (figures retained for this study)		7.170		38.000

Finally, for the needs in the 10 years to come, we shall retain the following values :

DESIGNATION	NIGER	NIGERIA
Mills :		
- Total needs	7.170	38.000
- Needs satisfied in 1982	1.430	12.400
Needs for 10 years	5.740	25.600
Dehullers :		
- Total needs for 10 years	7.170	$8.000 \leqslant X \leqslant 38.000$
Shellers	(for the record)	(for the record)
Water pumps	(for the record)	(for the record)

5. DETERMINATION DES DEMANDES :

a) Mills :

From the import licences applications in NIGER these last years :

(Source Ministry of Commerce).

1978/79	:	300
1979/80	:	324
1980/81	:	313
1981/82	:	336

i. e. : an average of 318 machines a year.

This demand correspond to needs established at about 700 machines a year. This means that the demand is of about 44 % of needs.

This figure seems quite reasonable in our opinion, considering the means of the populations concerned, Moreover, it would not be reasonable to expect that the satisfaction of needs as expressed would go 100 % on the local production.

b) Dehullers :

We have seen that it is very difficult to apprehend reasonably the needs. It will also be so for effective demand. We feel it would be unwise to count on an important demand from the start. In as much as the needs concern at the same time a mill and a dehuller, demand will first go for the mill, the machine which "produces the flour". Therefore, starting from this hypothesis, the demand for dehullers will concern at first only the population which already has a mill.

This hypothesis is certainly pessimistic, but it will allow, on the basis of a new model of dehuller that we suggest, to market small quantities of appliances, which will permit without taking any risk to test the effective demand and not to complicate the plant's production; this way, the plant will be able to become familiar with a single type of machine, the mill.

The production of dehullers will go increasing as fast as the needs in mills are satisfied. In this study, we will consider a demand calculated on basis of needs equivalent to the estimated number of existing mills in 1982.

c) Other machines :

- The sheller :

This appliance will certainly be in demand when the two preceding ones will be well implanted. The production unit will then be able to consider its production. The delay elapsing till then should allow to polish up a type of appliance well adapted to millet and sorghum.

It should be noted that the shelling of millet and sorghum is a rather tedious task for the women, in as much as it provoques itching possibly leading to dermitis.

- Small home mills :

Such small mills, operated by hand or with a small motor could have a market. It will belong to the new plant to define its characteristics considering the market.

- Water pumps :

These pumps could also be built later on, since the needs and the demand will go increasing.

RECAPITULATION OF NEEDS AND DEMAND

	NIGER				NIGERIA				NIGER + NIGERIA		REMARKS
	Existing machines in 1982	Needs in machines for 10 years to come	Yearly needs	Yearly demand 45 %	Existing machines in 1982	Total needs for the 10 years to come	Yearly needs	Yearly demand 45 %	Total yearly needs	Total yearly demand	
1. Mills :											
a) New mills		5.740	574			25.600	2.560				
b) (replacement for existing machines 10 % a year)	1.430		143		12.400		1.240				
Total			717	323			3.800	1.708	4.517	2.031	These figures do not take into account the needs of neighbouring countries. BENIN, UPPER VOLTA and MALI, which could be supplied by NIGER or NIGERIA.
2. Dehullers : see : page determination of needs		(1.430)	(143)	72		(12.400)	(1.240)	540	(1.383)	612	
3. Spare parts :	(For the record : 8,5 % of the value of mills and dehullers).										For the estimate of needs in dehullers, see preceding page.

6) PROGRAMME OF PRODUCTION AND PLANT CAPACITY :

The plant production programme will correspond to the demand, as defined on the chart on the preceding page :

- mills : : 2.031
- dehullers : 612
- spare parts concerning :
  . the mills (imported in a first stage)
  . the bearings or roller bearings (imported)
  . the axle leads
  . the mill bolts
  . the axles

The amount of spare parts corresponds to 8,5 % of the value of sales of mills and dehullers.

The daily production will be based on an operation of the plant of 230 days a year (135 days of stoppage, corresponding to weekly stoppage - saturdays, sundays, vacations and holidays).

The production will be realized with a crew working 8 hours a day.

Production Designation	Yearly production programme (at cruising speeding)	Daily Production Programme	Nominal daily production capacity	Remark
Mills	2.031	8,83		
Dehullers	612	2,66		* Spare parts in machine equivalent
Spare parts	(225)	(0,98) *		
TOTAL		12,47	22	

The nominal daily production capacity is calculated in order to cover a demand corresponding about to 80 % of total needs, those having been defined heretofore in mills, spare parts and dehullers, figures deliberately reduced for this study.

The production of machines and spare parts defined in this study correspond only to about 56 % of the nominal plant capacity, there is therefore a good margin for an increase of production without new investments.

A further increase of production of machines as defined, and for other machines, could be obtained by doubling the crews (two crews working each 8 hours) or by an increase in investments concerning the equipments, using in part the room available, planned in the first stage in the buildings, and increasing the needed uncovered areas, thanks to the space reserved for that.

We do not exclude that later on in the future, it would be profitable to plan 2 plants, specialized each on one or several types of machines, for instance mills and shellers and pumps in the other, one of the plant being implanted in NIGER and the other in NIGERIA.

Unit sales prices of mills and dehullers, as done by the plant have been defined in consideration of the average sales prices practiced in NIGER and NIGERIA.

In order for the national products to be competitive versus the imported foreign products, we have defined plant sales prices lower than the usual sales prices, therefore, the prices to private consumers and to resalers would be respectively 20 % and 28 % below the actual average prices.

The following tables indicate the level of these sales prices.

NOTA : In this study, we did not want to take "protectionist measures" into consideration.

SALES PRICES IN NIGER

Product Designation	Unit sales price designation	Unit price (amount in CFA)	Unit price (amount in M)
MILL	1. Average current price (imported material)	335.000	
	2. Plant sales price to private consumer (20 % rebate on (1)	268.000	536
	3. Plant sales price to resalers (28 % rebate on 1)	241.200	482,4
DEHULLER	1. Average current price (imported material)	510.000	
	2. Plant sales price to private consumer (20 % rebate on 1)	408.000	816
	3. Plant sales price to resaler (28 % rebate on 1)	367.200	734,4

SALES PRICES IN NIGER

Product Designation	Unit sales price designation	Unit price (amount in CFA)	Unit price (amount in N)
MILL	1. Average current price (imported material)		690
	2. Plant sales price to private consumer (20 % rebate on (1);	276.000	552
	3. Plant sales price to resalers (28 % rebate on 1)	248.500	497
DEHULLER	1. Average current price (imported material)		1.100
	2. Plant sales price to private consumer (20 % rebate on 1)	440.000	880
	3. Plant sales price to resaler (28 % rebate on 1)	396.000	792

EXHIBIT 8-1 ER ESTIMATE OF PRODUCTS OF SALES (IN 000 CFA)

PLANT IN NIGER

Products and by-products			1985						1986						FROM 1987						TO 1994					
DESIGNATION	Unit price		Quantities 50% for sale			Product of sales			Quantities 100% for sale			Product of sales			Quantities 100% for sale			Product of sales			Quantities 100% for sale			Product of sales		
	Int. P	Int. R	Int. P	Int. R	TOTAL	Int. P	Int. R	TOTAL	Int. P	Int. R	TOTAL	Int. P	Int. R	TOTAL	Int. P	Int R	TOTAL	Int. P	Int. R	TOTAL	Int. P	Int. R	TOTAL	Int. P	Int. R	TOTAL
SALES IN NIGER																										
- Mills	258	241,2	57	105	162	15142	25326	40468	113	210	323	30284	50652	80936	113	210	323	30284	50652	80936	113	210	323	30284	50652	80936
- Dehullers	408	367,2	13	23	36	5100	8629	13729	25	47	72	10200	17258	27458	25	47	72	10200	17258	27458	25	47	72	10200	17258	27458
- Spare parts						1721	2886	4607				344	5772	9213				3441	5772	9213				3441	5772	9213
Total NIGER						21963	36841	58804				43925	73682	117607				43925	73682	117607				43925	73682	117607
SALES IN NIGERIA																										
- Mills	276	248,5	299	555	854	82524	137917	220441	598	1110	1708	165048	275835	440883	598	1110	1708	165048	275835	440883	598	1110	1708	165048	275835	440883
- Dehullers	440	396	95	175	270	41580	71478	113058	189	361	540	83160	142956	226116	189	361	540	83160	142956	226116	189	361	540	83160	142956	226116
- Spare parts						10548	17799	28347				21097	35598	56695				21097	35598	56695				21097	35598	56695
Total NIGERIA						134652	227194	361846				269305	454389	723694				269305	454389	723694				269305	454389	723694
GRAND TOTAL (NIGER + NIGERIA)						156615	264035	420650				313230	528071	841301				313230	528071	841301				313230	528071	841301

NOTA :

- Int. P = Internal market - Direct sales to private consumers.
- Int. R = Internal market - Sales to resalers.
- The indications 50 % and 100 % in the above table take under the beading " quantities for sale" are percentages of the considered production programme and not of the plant's nominal capacity.

EXHIBIT 3-1 IA

ESTIMATE OF PRODUCTS OF SALES (IN NAIRA)

PLANT SITED IN NIGERIA

Products and by-products			1985						1986						FROM 1987						TO 1994					
DESIGNATION	Unit Price		Quantities 50 for sale			Product of sales			Quantities 100 for sale			Product of sales			Quantities 100 for sale			Product of sales			Quantities 100 for sale			Product of sales		
	Int. P	Int. R	Int. P	Int. R	TOTAL	Int. P	Int. R	TOTAL	Int. P	Int. R	TOTAL	Int. P	Int. R	TOTAL	Int. P	Int R	TOTAL	Int. P	Int. R	TOTAL	Int. P	Int. R	TOTAL	Int. P	Int. R	TOTAL
SALES IN NIGER																										
- Mills	536	482,4	57	105	162	30284	50652	80936	113	210	323	60568	101304	161872	113	210	323	60568	101304	161872	113	210	323	60568	101304	161872
- Dehullers	816	734,4	13	23	36	10400	17058	27458	25	47	72	20400	34516	54916	25	47	72	20400	34516	54916	25	47	72	20400	34516	54916
- Spare parts						3441	5772	9213				6882	11544	18426				6882	11544	18426				6882	11544	18426
Total NIGER						44125	73482	117607				87850	147364	235214				87850	147364	235214				87850	147364	235214
SALES IN NIGERIA																										
- Mills	552	497	299	555	854	165048	275835	440883	598	1110	1708	330096	551670	881766	598	1110	1708	330096	551670	881766	598	1110	1708	330096	551670	881766
- Dehullers	880	792	95	175	270	83160	142956	226116	189	361	540	166320	285912	452232	189	361	540	166320	285912	452232	189	361	540	166320	285912	452232
- Spare parts						21097	35598	56695				42194	71196	113390				42194	71196	113390				42194	71196	113390
Total NIGERIA						269305	454389	723694				538610	908778	1447388				538610	908778	1447388				538610	908778	1447388
GRAND TOTAL (NIGER + NIGERIA)						313430	527871	841301				626460	1056142	1682602				626460	1056142	1682602				626460	1056142	1682602

NOTA : See table exhibit 3-1 ER

Exhibit 3-2 ER

ESTIMATE OF COST OF PRODUCTION : COST OF SALES AND DISTRIBUTION

ESTIMATE OF COST OF PRODUCTION (PLANT IN NIGER)						
Cost of sales and distribution in NIGER and NIGERIA						
DESIGNATION	YEAR 1985			FOR EACH YEAR 1986 TO 1994		
	Cost in 000 CFA			Cost in 000 CFA		
	Foreign Exchange	Local Currency	TOTAL	Foreign Exchange	Local Currency	TOTAL
- COST OF DISTRIBUTION FREIGHT 2 % OF PRICE OF SALES	6.310	2.103	8.413	12.620	4.206	16.826
- COMMISSIONS AND LICENCES FEES 4 % OF PRICE OF SALES	16.826		16.826	33.652		33.652
TOTAL	23.136	2.103	25.239	46.272	4.206	50.478

Exhibit 3-2 IA

ESTIMATE OF COST OF PRODUCTION : COST OF SALES AND DISTRIBUTION

ESTIMATE OF COST OF PRODUCTION (PLANT IN NIGERIA)						
Cost of sales and distribution in NIGER and NIGERIA						
DESIGNATION	YEAR 1985			FOR EACH YEAR 1986 TO 1994		
	Cost in Naira			Cost in Naira		
	Foreign Exchange	Local Currency	TOTAL	Foreign Exchange	Local Currency	TOTAL
- COST OF DISTRIBUTION FREIGHT 2 % OF PRICE OF SALES	4.206	12.620	16.826	8.413	25.239	33.652
- COMMISSIONS AND LICENCES FEES 4 % OF PRICE OF SALES	33.652		33.652	67.304		67.304
TOTAL	37.858	12.620	50.478	75.717	25.239	100.956

EXHIBIT 3 - 3

PRODUCTION PROGRAMME (NIGER OR NIGERIA)

PRODUCTS BY-PRODUCTS WASTE	PLANT OF NOMINAL CAPACITY (100%)	1ST ANNEE 1985		2ND YEAR 1986		TO YEAR 1994	
		Plant Capacity 28,3%	Units	Plant Capacity 56,6 %	Units	Plant Capacity 56,6 %	Units
1. Mills			1.016		2.031		2.031
2. Dehullers			306		612		612
3. Spare parts			(112)		(225)		(225)
T O T A L	5.060		1.434		2.868		2.868

The figures indicated under 3, spare parts are the machine-equivalent, derived from the amount of sales.

Exhibit 3-4

ESTIMATE OF COST OF PRODUCTION

ELIMINATION OF EFFLUENTS

ESTIMATE OF COSTS OF PRODUCTION IN NIGER AND NIGERIA			
Evaluation of effluents (for the record)			
DESIGNATION	C O S T		
	Foreign Exchange	Local Currency	TOTAL
1. Treatment of effluents and emanations (if not included in equipment and civil works) 2. Emptying in dumps or in sewers 3. Indemnities to pay to neighbours			For the record
T O T A L			

NOTA : No expenses are provided for in the unit to be built for effluents.

IV. MATERIAL AND PRODUCTION FACTORS

- Introduction

- Characteristics of material and production factors

- Costs of production
  (exhibits 4-1 ER, 4-1 IA, 4-2)

I. INTRODUCTION :

Concerning the mills, which will constitute the basic product to manufacture in the first stage, it has been accepted that the maximum of components would be produced locally. Thus the mill's body is planned in welded steel, instead of being in cast iron, until a cast-iron foundry be created in NIGER or NIGERIA. Actually, for NIGER, there is a study under process (at the UNIDO, under the reference DP/NER/81/020 "Creation of a cast iron foundry and forge plant").

If this project gets realized, it could be according to the informations we obtained at the UNIDO in NIAMEY, approximately at the same period as that of the mill manufacturing plant. However, at the present time, the risk should not be taken to count on its hypothetical existence.

The same goes for the iron and steel industry programme planned in NIGERIA. After the establishment of the concrete steel rods plant in KATSINA, it is planned to create several plants, among which a cast iron foundry. However, up to now, neither the location or the date of construction have been decided upon.

That such a plant would exist in one or the other of the two countries would be a highly favorable element for the production of parts such as machines' bodies, and also for the local production of quality mill plates and of pullies.

For the proposed-type dehuller, all the essential components are out of steel; the body is in steel, and can be produced locally from imported steel sheets. The rotor's plates, being either in carburundum or in resinoïds should be imported (see IDRC appended document, including the list of components and the plans).

2. CHARACTERISTICS OF MATERIALS AND PRODUCTION FACTORS

a) Among the rawstuff are mainly :

- Sheet steel for the production of :
  . appliances' body.
  . intake hoppers.
  . basis plates for mill and motor.
  . corner irons and iron supports for appliance and hopper.
  . miscellaneous items.

- Compressed steel for the production of :
  . shafts
  . axles
  . nuts and bolts.
  . miscellaneous items.

- Hollow castings in steel and in bronze, for the collars.

b) Manufactured items are mainly :

- the plates.
- the bearings and roller bearings.
- the pullies.
- the springs.
- miscellaneous items.

c) Auxiliary staff, such as paint.

d) The workshop supplies, to wit :

- machine tools equipment and wear parts, cutting parts.
- expendable supplies (oils, greases, cutting oil, cleaning products).

- welding rods
- bottles of gaz, CO_2, oxygen and acetylen

e) Miscellaneous supplies

- wood for packing.
- office supplies.

f) Utilities and exterior services :

- water
- electricity
- gas and motor oils
- diesel fuel

Remarks :

As can be noted in 4-1. ER and 4-1. IA, and 4-2 IA, and 4-2 charts, the products listed in paragraphs a, b, c, and d will be imported, if not wholly, at least for the most part.

EXHIBIT 4-1 ER

ESTIMATE OF COSTS OF PRODUCTION - MATERIAL AND PRODUCTION FACTORS

ESTIMATE OF COSTS OF PRODUCTION IN NIGER

Matérials and production factors

DESIGNATION	YEAR 1985			FOR EACH YEAR FROM 1986 TO 1994		
	COST (000 F CFA)			COST (000 F CFA)		
	Foreign Exchange	Local Currency	TOTAL	Foreign Exchange	Local Currency	TOTAL
1. Not transformed or haft-transformed rawstuff : Sheet-steel, round irons, hollow castings, girders and corner irons, miscellaneous.	38.678	19.031	57.709	77.356	38.061	115.417
2. Industrial materials and components: Plates, bearings, pullies, screws, paint and miscellaneous items.	78.105	15.624	93.729	156.211	31.248	187.459
3. Expendable supplies and miscellaneous : welding rods, machine tool equipment oxygen, acetylen, CO_2, cutting oil, wood for packing, cleaning products, stationery etc...	2.614	6.929	9.543	5.228	13.858	19.086
4. Utilities and exterior services expenses : water, electricity, gas, diesel fuel		3.857	3.857		7.714	7.714
TOTAL	119.397	45.441	164.838	238.795	90.881	329.676

EXHIBIT 4-1 IA

ESTIMATE OF COSTS OF PRODUCTION - MATERIAL AND PRODUCTION FACTORS

ESTIMATE OF COSTS OF PRODUCTION IN NIGERIA

Matérials and production factors

DESIGNATION	YEAR 1985			FOR EACH YEAR FROM 1986 TO 1994		
	COST (in Naira)			COST (in Naira)		
	Foreign Exchange	Local Currency	TOTAL	Foreign Exchange	Local Currency	TOTAL
1. Not transformed or haft-transformed rawstuff : Sheet-steel, round irons, hollow castings, girders and corner irons, miscellaneous.	77.356	35.551	112.907	154.712	71.103	225.815
2. Industrial materials and components: Plates, bearings, pullies, screws, paint and miscellaneous items.	156.211	29.427	185.638	312.422	58.855	371.277
3. Expendable supplies and miscellaneous : welding rods, machine tool equipment oxygen, acetylen, CO_2, cutting oil, wood for packing, cleaning products, stationery etc...	5.228	13.908	19.136	10.456	27.816	38.272
4. Utilities and exterior services expenses : water, electricity, gas, diesel fuel		7.605	7.605		15.211	15.211
TOTAL	238.795	86.491	325.286	477.590	172.985	650.575

EXHIBIT 4-2 RECAPITULATION OF COSTS OF PRODUCTION - MATERIALS AND PRODUCTION FACTORS

RECAPITULATION - COST OF PRODUCTION IN NIGER AND NIGERIA

MATERIALS AND PRODUCTION FACTORS

Project element	Reported costs of production - year 1985			Cost of production for years 1986 to 1994		
Designation	Foreign exchange	Local Currency	TOTAL	Foreign exchange	Local Currency	TOTAL
NIGER (Costs of production in 000 CFA)						
- Rawstuff	38.678	19.031	57.709	77.356	38.061	115.417
- Components	78.105	15.624	93.729	156.211	31.248	187.459
- Expendable supplies	2.614	6.929	9.543	5.228	13.858	19.086
- Exterior services		3.857	3.857		7.714	7.714
TOTAL NIGER	119.397	45.441	164.838	238.795	90.881	329.676
NIGERIA (Costs of production in ₦)						
- Rawstuff	77.356	35.551	112.907	154.712	71.103	225.815
- COmponents	156.211	29.427	185.638	312.422	58.855	371.277
- Expendable supplies	5.228	13.908	19.136	10.456	27.816	38.272
- Exterior services		7.605	7.605		15.211	15.211
TOTAL NIGERIA	238.795	86.491	325.286	477.590	172.985	650.575

V. LOCATION AND SITING

. Location

. Costs of investment (land)

(exhibits 5-1 and 5-2)

I. LOCATION :

Introduction :

The production unit should be as near as possible to the areas in which its production will be in use, in order to minimize the costs related to transportation.

Since we advise, in a first step, the construction of a single unit, either in NIGER or in NIGERIA, the plant should be well located with respect to these two countries, and have good connexions with the different user regions of them by a good road network.

On the other hand, this unit should be in the industrial area of a town, the plot put at its disposal being large enough to allow a further expansion and for which the availability in water and in electricity (National network) would be ensured without problems.

The town and its region should allow the recruitement of most of the needed manpower (administrative and technical).

At last, the production unit should be connected to the national and international telephone and telex networks.

Zones for plant establishment :

After the visits we have made in both the countries concerned, we advise two zones for plant establishment : one in NIGER and one in NIGERIA. The two of them seem to us to be capable of filling the maximum of the required conditions for such an establishment. It should also not be forgotten that neighbouring countries such as MALI, UPPER VOLTA and BENIN could become potential and not negli-

gible customers. (According to some information sources, this market could be equal to the one of NIGER and NIGERIA).

In view of establishment of the plant in NIGER, we are of the opinion that the best location would be on the BIRNI-N'KONI/MARADI road axis, and in the sector defined by these two towns, respectively in the TAHOUA and MARADI Departments. These two towns are well located in relation to the millet and sorghum production centres, and moreover, they have lines of communication with NIGERIA, close by, and its principal production regions.

In particular, there is in the town of MARADI a well laid out industrial development area, with the required water and electricity equipments and available large development areas.

We have been able to visit there the CFDT cotton ginning plant. This plant, stopped since a few years, could be recovered and adapted for the production of mills. There is the plant itself, of a 300 m^2 covered area, including a shopfloor, different workshops and offices, and about 500 m^2 in the open, with a concrete floor, breeze blocks walls divide this surface in five zones (see plan N° 3, appended). Moreover, there is a 4 room accommodation, suitable for an executive or a supervisor.

For a construction in NIGERIA, we would think of a location in the GUSAU - KATSINA - KANO triangle, these towns being located respectively in the SOKOTO, KADUNA and KANO States of NIGERA.

These three towns are well located in relation with the production centres of NIGER and NIGERIA, with a good road network. Moreover, GUSAU and KANO are on railroad lines.

Important remarks :

The quoted towns, in NIGER as well as in NIGERIA, are not far from the town of ZARIA. This Nigerian city is particularly interesting on account of its Agricultural Research Institute, in AHMADU BELLO University (ABU). Actually, there is in this Institute an Agricultural Engineering Department, quite efficient and above all the pressures and lobbying which could be exerted to have certain materials admitted.

A fruitful cooperation could be established between an eventual mill production unit and the Agricultural Research Institute, in the greatest interest for both countries.

It is with the help and advice of this Institute that could be made the final choice of the best-adapted type of plate-mill; afterwards, it is with its help that could be tested and perfected before going in industrial production the dehuller, and finally the millet and sorghum sheller.

This Institute could bring precious help to the research department, with which the plant should be equipped, in view of all the improvements on its products or the creation of new ones.

Estimate of costs :

The establishment of such an industrial unit presenting such an interest for the town in which it would be sited, we have taken as a hypothesis that the Enterprise would be exempted from the expenses related to the cost of the land and to the taxes and legal fees pertaining to it. We have also set the hypothesis that there would be no right of way or other constraints.

All the different authorities we met through our journeys confirmed these hypothesis.

Therefore, charts 5-1 and 5-2 are quoted only for the record.

Choice of siting and local conditions :

This study cannot, in any way, give other indications than the ones figuring in the previous paragraphs. Since the final choice of the site belongs to the competent authorities only, local conditions can vary from one site to another within quite large limits.

It will be the task of the feasibility study, once chosen the location, to answer the precise questions concerning the site and the local conditions :

- situation (town, street, etc...)
- geographical and topographical conditions.
- according to the maps at suitable scales, indication of the orientation, limits, neighbours, contour lines, road and other connexions, utilities connecting-up, soil and subsoil conditions, etc...

ESTIMATE OF INVESTMENT COSTS (for the record)

Exhibit : 5.1

LAND

ESTIMATE OF COST OF INVESTMENT - NIGER AND NIGERIA			
Land			
	COST		
DESIGNATION	Foreign Exchange	Local Currency	TOTAL
- Land - Taxes - Legal fees - Indemnities paid to neighbours - Rights of way	(FOR THE RECORD)		
TOTAL		none	none

EXHIBIT 5-2 ESTIMATE OF COST OF PRODUCTION (for the record)

LAND

ESTIMATE OF COST OF INVESTMENT - NIGER AND NIGERIA			
Land			
DESIGNATION	COST		
	Foreign Exchange	Local Currency	Total
Yearly payments for : - Rights of way - Constraints - Rents		(FOR THE RECORD)	
TOTAL		none	none

VI./VII. PROJECTS' TECHNICAL ASPECTS

- Sketches of project
- Range of project
- Technologies
- Equipment
- Civil engineering
- Investments

  (exhibits 6-2 / 6-3 ER / 6-2 IA / 6-4 ER / 6-4 IA/ 6-5 ER / 6-5 IA)

SKETCHES OF PROJECT :

In chapter III, we have defined a yearly demand, starting from the needs, demand which served to define the production unit.

Letting the demand in mills be of 2.031 appliances, and in dehullers of 612. This last figure is willingly quite under-estimated, for the reasons exposed in chapter III.

A yearly production of 2.031 mills corresponds, on basis of 230 working days a year, to a daily production of about 8,83 appliances and 612 dehullers to about 2,66 appliances a day, that is a daily total of about 11,4 appliances.

To that figure, should be added the spare parts, computed in appliance equivalent at about 0,98 appliances a day.

Therefore the daily production programme would be, on the average, for a whole year of about 12,47 appliances.

EQUIPMENTS :

The list of the equipment required for the manufacturing of mills figures hereafter on chart 6-2. These equipments will allow a nominal production of 22 appliances a day; the daily production schedule being of about 12,5 appliances, the machine-tools will work at about 57 % of their maximum capacity. It should be noted that we have included in the list of the required equipment a power generating-set, essential to make up for hte national electric power interruptions of supply and therefore permit to maintain the rhythm of production as planned in our study. The cost of equipments figures on the same chart N° 6-2.

CIVIL ENGINEERING :

The plant will be built on a plot of a surface of about 5.000 m^2. The total constructed area of 1.050 m^2 will include :

- The mechanical and vessel workshop.
- The spare parts and appliances stores.
- The shipping floor.
- The administrative and technical offices.

See plans N° 1 and 2 (volume 2).

The land hold of 5.000 m^2 of the plant will permit to set up parking lots, lots for the stocking of rawstuff as well as for future extensions of workshops, stores and offices. At last, there will be the possibility to build there some accommodations which go with a post.

Detail of built area :

. Offices	210 m^2
. Mechanic floor	216 m^2
. Vessel work floor	144 m^2
. Workshops offices	48 m^2
. Stocking finished products	120 m^2
. Shipping	48 m^2
. Spare parts store	140 m^2
. Paint shop	36 m^2
. Steel and iron depot	130 m^2
. Transformer local	16 m^2
. Diesel local	20 m^2

Miscellaneous : 12 car parks.

PROJECT SPECIFICATIONS AND DESCRIPTION :

Introduction :

The project includes the plant itself and the offices.

a) Regulations :

The studies should be led in accordance with standards and regulations in force in the country under consideration. In France and in the countries, which have adopted the same legislation, those are the following :

- Risks of earthquakes. Study, in conformity with anti-earthquake rules of 19 69.
- Climate conditions. French rules NV 65 modified in 1967, 1974 and 1979.

. For metallic constructions :

Rules CM 66 for the calculation of frames, roofing, aluminum coating as well as the D.T.U. of the "French Centre Scientifique et Technique du Bâtiment"(CSTB) and the AFNOR norms.

. For the reinforced Concrete structures :

CCBA 1968 rules as modified for the calculation of reinforced concrete elements. The whole of the constructions will be subject to the directions of the DTU of the CSTB.

. For electricity :

CEI and Union Technique de l'Electricité (UTE) rules for the execution of electrical installations.

. Fire protections :

French safety rules.

b) General lay-out :

Land :

The whole of circulation lanes within the industrial development area serving :
- the plant.
- the offices.

Two types of lanes :
- Large circulation lanes, 6 m wide
- Service ways, 4,5 m wide.

Character of the works :

- Scraping, resurfacing and compaction of the land,
- Foundations, with a layer of anti-contamination sand of 0,10 m thickness, foundation layer in compacted lateritic gravel, stabilized of 0,20 m thickness.
- impregnation.
- two coat surface.

c) Varied networks :

- Rain water :
  . along the roads, open ditches.
  . underground sewers, to collect rain water coming from buildings.
  . evacuation to the limits of plant perimeter.

- Decontamination of process waters (for the record).

- Decontamination of liquid wastes :

  Toilet waters collected in septic pits, and evacuated by cesspools.

d) Fluids network :

Common ditches for passage of networks as follows :
- Drinking water main
- Fire protection water main
- Industrial water main
- Separate lighting and electric mains.

f) Plant and workshop buildings :

. Metal skeleton building, including :
  - workshops
  - offices
  - mechanics floor
  - vessel work floor
  - stocking of finished products
  - shipping floor
  - spare parts store

. Foundations :

The whole of the building will have superficial type foundations, realized in bedplates, separate or continued, calculated for a work rate of 2 bars, linked by reinforced concrete pile caps.

. Floor paving :

On a compacted laterite embankment, the floor will be realized in lightly reinforced concrete, allowing the circulation of handling vehicles. The machines will rest on independant concrete mast.

. Structures in elevation :

Metal frame structures, realized in porticos 4 m from one another; the framework will include all the components necessary for stability : tighteners, braces, etc...

. Fronts and sides :

Base in stonework, coated on one side, wall in elevation in metal sheeting (aluminum) with lighting strips and ventilation.

. Roofing :

Realized in aluminum troughs, set on the framework with a repartition of lighting, strips to allow a zenithal lighting. Collection of rainwater will be realized in the gutters, linked to the rainwater network.

. Access doors :

Metal doors, of the sliding type, with a 4 m x 4 m passage way, giving access to the workshops, the shipping floor and the spare parts store.

Metal doors for personnel entry to the plant stores and technical premises : compressor, diesel, toolshop, and to the offices.

. Ventilation :

Metal shutters on front and sides of the industrial building, providing a good ventilation.

. Lighting and electricity distribution :

Industrial fluorescent lamps water tight.:
- General lighting by fluorescent bulbs
- Local lighting by fluorescent tubes.

Public lighting lamps at the access and along the cirulation lanes.

Diesel premises : mechanical ventilation.

. Offices :

- Surface land area : 258 m^2.
- Reinforced concrete structure, realized in posts, linked by chaining.
- Front and sides : filling in breeze blocks of 250 mm.
- Distribution partition in breeze blocks of 100 mm.
- Carpentry : outside : metallic, including entrance doors.
  inside : wooden.
- wall facings :
  . Concrete
  . Coating on outside.
- Wall coverings :
  . (inside): fine concrete.covering (outside walls and partitions).
  . tile (earthenware) on sanitary walls, up to 2 m.
  . Vinylic paint in offices and passage.
- Sanitary equipment, plumbing.
  . Washroom, with turkish type toilets and 1 washbasin.
  . Plumbing : supply and distribution of cold water.
- Electric installation and air-conditioning :
  . Lighting with fluorescent lights.
  . Air-conditioners or ventilators in the offices.

INVESTMENTS :

Chart 6-2 hereafter brings together list of the equipments required for the manufacture of mills or other appliances and the cost of these equipment, their putting-up and starting-up. The following charts recapitulate, for each country, the costs of investments, equipments and the civil engineering works.

We consider in our study that the buildings and civil engineering works will have a depreciation calculated on 20 years, while the auxiliary service and miscellaneous equipments will have it calculated on 10 years. It should be noted that for the workshop equipments, this duration is estimated in consideration of 2.000 hours a year of operation.

EXHIBIT 5.2 - LIST OF EQUIPMENT AND ESTIMATE OF COSTS OF INVESTMENTS

(FOR NIGER & NIGERIA)

ESTIMATE OF COST OF INVESTMENT

Equipments

N°	Quantity	DESIGNATION	Cost (FF)	Cost (000 CFA) NIGER			COST IN ₦ NIGERIA		
			FOB French port	Foreign Exchange	Local Currency	TOTAL	Foreign Exchange	Local Currency	TOTAL
1		EQUIPMENT PRODUCTION WORKSHOP :							
	2	Parallel lathe point height 250 mm distance between points 2 m.	245 600						
	1	Shears 2.000 x 6 mm	131 000						
	1	Folding machine operator 2000 x 6mm	200 000						
	1	Rolling machine operator 2050 x 6mm	83 300						
	1	Radial drill Ø 30	38 500						
	1	Column drill Ø 12	12 500						
	1	Universal milling machine	147 900						
	1	30 T hydraulic press	89 000						
	2	Electrical grinding wheel	22 030						
	1	Mechanical saw	33 900						
	1	Flame cutting machine	25 000						
	3	Semi automatic welding sets	37 500						
	4	300 A welding sets	43 200						
	1	Painting room	56 500						
2		AUXILIARY EQUIPMENT :							
	1	Forklift truck 3m/IT (electric engine)	69 200						
	1	Apron plate carrier	3 000						
3		SERVICE EQUIPMENT :							
	1	Compressor 210 l/mn 10 B	4 950						
	1	Transformer 200 KVA (20/0,4 KV)	21 900						
	1	Diesel power generator 200 kVA 400V	155 300						
4		MISCELLANEOUS EQUPMENTS :							
		Electricity Lighting Compressed air Water Air conditioning	192 500						
5		SPARE PARTS EXPENDABLE PARTS : (tools, parts normally used)	131 900						
6		TOTAL COST (in FF, CFA, ₦) (1+2+3+4+5)	1 744 680 FF	87 234 CFA		87 234 CFA	174 468 ₦		174 468 ₦
7		Sea freight + insurance (4,5 % of FOB value)		3 926		3 926	7 852		7 852
8		Custom, taxes, others (20% of the FOB value)			18 232	18 232		36 464	36 464
9		Local transport			1 575	1 575		2 800	2 800
10		Setting-up and starting-up		10 468	2 617	13 085	20 936	5 234	26 170
		TOTAL COST IN CFA & ₦ (6+7+8+9+10)		101 628 (CFA)	22 424 (CFA)	124 052 (CFA)	203 256 (₦)	44 498 (₦)	247 754 (₦)

Exhibit 6-3 ER

RECAPITULATION

EQUIPMENT INVESTMENT COSTS

RECAPITULATION - EQUIPMENT INVESTMENT COSTS

EQUIPMENT - PLANT IN NIGER

Element of project	Reported costs of production (000 CFA)		
DESIGNATION	Foreign Exchange	Local Currency	TOTAL
Equipments	87.234		87.234
Sea freight and Insurance	3.926		3.926
Costom fees		18.232	18.232
Local transportation		1.575	1.575
Setting-up and starting-up	10.468	2.617	13.085
TOTAL	101.628	22.424	124.052

Exhibit 6-3 IA

RECAPITULATION

EQUIPMENT INVESTMENT COSTS

RECAPITULATION - INVESTMENT COSTS			
Equipment - Plant in NIGERIA			
Element of project	Reported costs of production (in ₦)		
DESIGNATION	Foreign Exchange	Local Currency	TOTAL
Equipments	174.468		174.468
Sea freight and insurance	7.852		7.852
Custom fees		36.464	36.464
Local transportation		2.800	2.800
Setting-up and starting-up	20.936	5.234	26.170
TOTAL	203.256	44.498	247.754

Exhibit 6.4 ER

ESTIMATE OF COSTS OF INVESTMENT
CIVIL ENGINEERING WORKS

ESTIMATE OF COSTS OF INVESTMENT				
Civil Engineering work - Plant in Niger				
		Cost (000 CFA)		
DESIGNATION	Unit cost CFA/m2	Foreign Exchange	Local Currency	TOTAL
1. Preparation of plant site (about 1.300 m^2)			5.000	5.000
2. Buildings and civil engineering works 790 m2 industrial construction 260 m2 offices	100.000	31.600	47.400	79.000
3. Miscellaneous fitting-up :	130.000	13.520	20.280	33.800
. Fence, for a 5000m2 land . Parkings . Water and electricity connections			8.400	8.400
TOTAL		45.120	81.080	126.200

Exhibit 6-4 IA

ESTIMATE OF COSTS OF INVESTMENT
CIVIL ENGINEERING WORKS

ESTIMATE OF COSTS OF INVESTMENT				
Civil Engineering work - Plant in NIGERIA				
		Cost (in ₦)		
DESIGNATION	Unit cost ₦ /m2	Foreign Exchange	Local Currency	TOTAL
1. Preparation of plant site (about 1.300 m2)			12.500	12.500
2. Buildings and civil engineering works. 790 m2 industrial construction	200	47.400	110.600	158.000
260 m2 offices	300	23.400	54.600	78.000
3. Miscellaneous fitting-up :				
. Fence, for a 5.000 m2 land . Parkings . Water and electricity connections			20.160	20.160
TOTAL		70.800	197.860	268.660

Exhibit 6.5 ER

RECAPITULATION - COSTS OF INVESTMENTS

CIVIL ENGINEERING WORKS

RECAPITULATION - COSTS OF INVESTMENTS			
CIVIL ENGINEERING WORKS - PLANT IN NIGER			
Element of project	Reported production costs (000 CFA)		
DESIGNATION	Foreign Exchange	Local Currency	TOTAL
Site preparation		5.000	5.000
Buildings and civil engineering works	45.120	67.680	112.800
Miscellaneous fitting-up :		8.400	8.400
TOTAL	45.120	81.080	126.200

Exhibit 6.5 IA RECAPITULATION - COSTS OF INVESTMENTS
CIVIL ENGINEERING WORKS

RECAPITULATION - COSTS OF INVESTMENTS			
Civil Engineering Works - Plant in NIGERIA			
Element of project	Reported production (costs in ₦)		
DESIGNATION	Foreign Exchange	Local Currency	TOTAL
Site preparation		12.500	12.500
Buildings and Civil Engineering works	70.800	165.200	236.000
Miscellaneous fitting-up		20.120	20.120
TOTAL	70.800	197.820	268.620

VIII. MANPOWER

- Personnel
- Organization chart
- Workers schedule and cost of personnel

(Exhibits 8/1-4 ER and 8/1-4 IA)

The total number of workers for the production unit will at the start be of 56 persons, broken down by services as follows :

- Direction : 1
- Administration and accounting services : 9
- Sales and after-sales service : 5
- Supplies service : 10
- Research department : 1
- Mechanics, vessel work and assembly workshops : 30

a) Direction :

The Plant Manager should be a good administrator and a good technician; he should be an Engineer, graduate of an important School of Engineers, with a mechanics or electro-mechanics education. He will be directly in charge of the engineering Department.

b) The Administration and Accounting Service will include :

The Chief Accounting and Administration, hierarchically responsible for :

- 2 accountants
- 1 personnel management officer
- the secretariat (with 2 secretaries)
- 1 receptionist
- 2 chauffeurs.

c) The Sale and After-Sales Service will include :

The Chief of the Sales and After-Sales Service, responsible for 4 clerks, in charge of customers' follow-up and of the orders.

d) Supplies Service :

The Head of the supplies, preferably of a basic technical education, responsible of the service which includes :

- 1 Clerk in charge of the rawstuffs and spare parts supplies.
- 1 Clerk, in charge of the receptions and shipments of matters and materials.
- 4 Employees, assigned to the steel and iron depot, the finished appliances store and to the shipping.
- 3 Watchhousemen.

e) Engineering Department :

At the start, the Engineering Department will include only a draughtsman, of a general mechanics master education level. The Engineering Department will work in contact with the Workshops Manager and wiht the Chief of the Sales and After-sales Department. His role will be be to draw the plans for mill set-ups(standard plan). to follow the blueprints for the setting up of mills designed by the license lessor and to bring the eventual modifications needed for an adaptation to local conditions and that, in contact with the After-sales service, the workshop and the license lessor.

The Research Department will participate in the studies of the new appliances, under the direct control of the Plant Manager and in close contact with the workshop, for that purpose, he will be in contact with research and studies Centres such as the one of AHMADU BELLO University, ZARIA in NIGERIA.

f) Workshops :

The Chief of the Mechanic and vessel workshops hierarchically

responsible for the following production personnel :

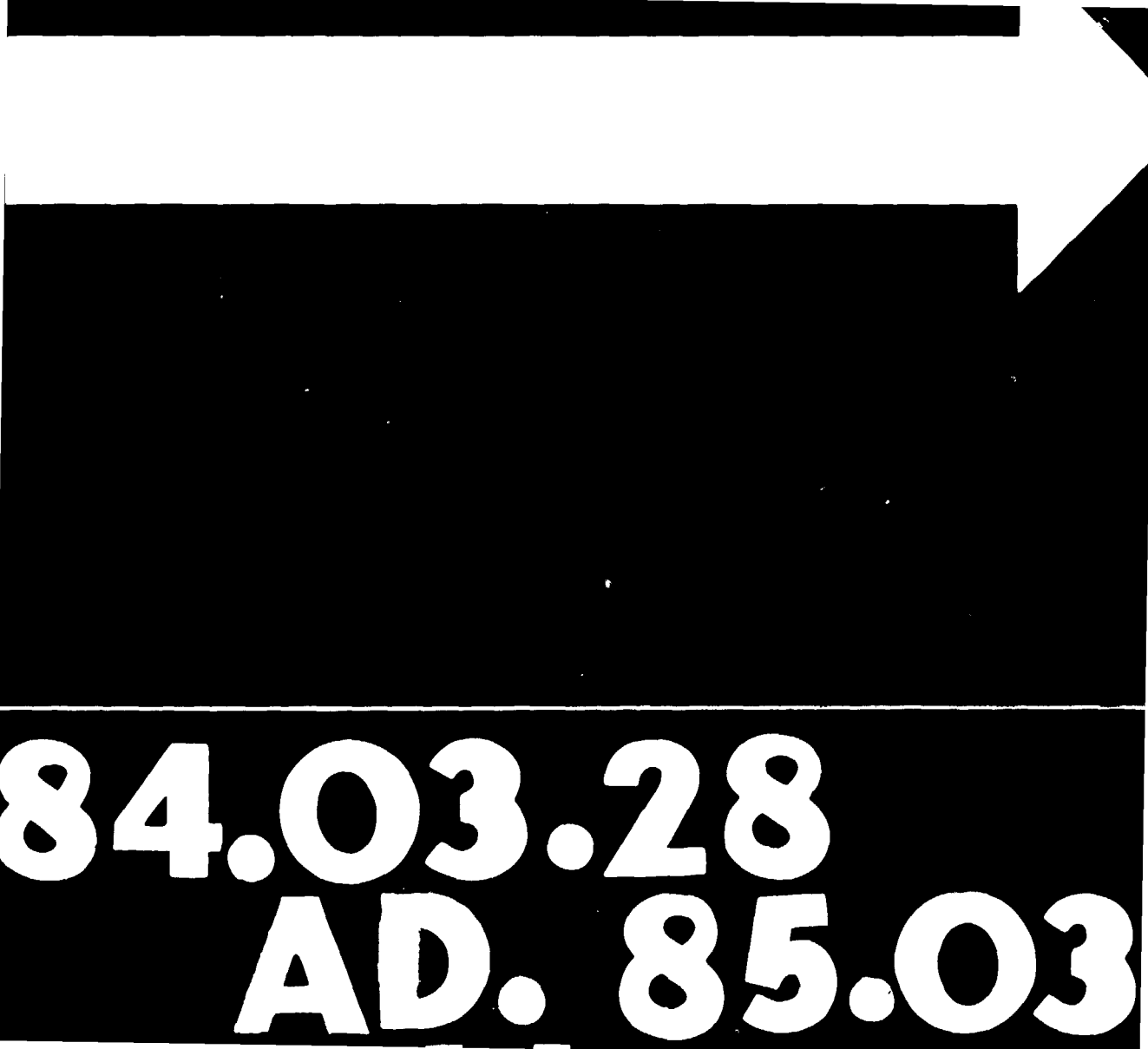
- 2 lathe operators.
- 1 Milling machine operator.
- 1 qualified operator, assigned to the steel folding and rolling machines
- 4 mechanics.
- 4 welders.
- 2 vessel makers.
- 2 painters
- 1 fork-lift truck operator.
- 6 helpers
- 6 labourers.

Important notice :

We consider that the positions of Plant Manager, responsible of supplies and Chief of the workshops should be held by expatriates for at least two years. We have planned for this lapse of time, that national executives could be recruited and formed in order to take over. These executives should not have, at the start, the title of deputy to the above mentioned officials,but should be in charge of various positions in the plant for a few months. Thus, the future Plant Manager should go through the workshops, the supplies and the after-sales service. The expatriate executives should, over and on top of their mission, ensure the training of their Nigerian or Nigerien Counterparts.

Social Security contributions :

On account of the information obtained in each of the two countries concerned regarding the social security contributions, we have retained the figure of 20 % of the amount of salaries.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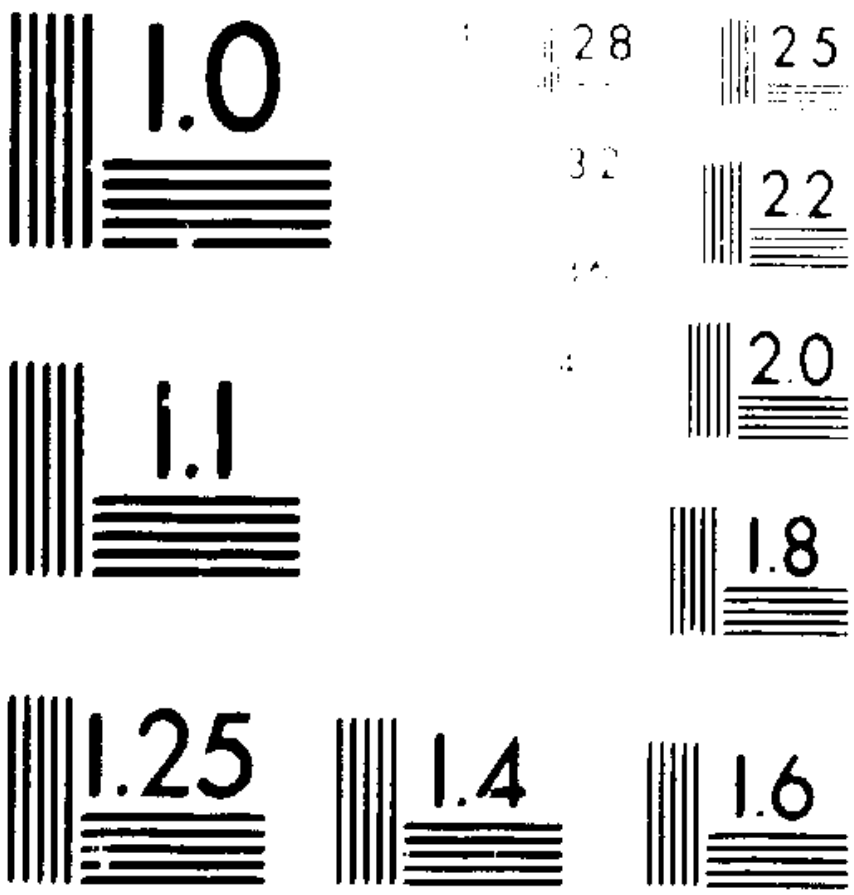


- For NIGER , they include :

  . the family benefits contributions
  . the contribution for work accident and professional illnesses liabilities
  . the retirement scheme
  . the apprenticeship tax
  . various taxes

- For NIGERIA, they include :

  . the illness protection
  . the retirement scheme
  . various benefits in kind : housing, transportation, etc...

ORGANIZATION CHART (NATIONALS PERSONNEL)

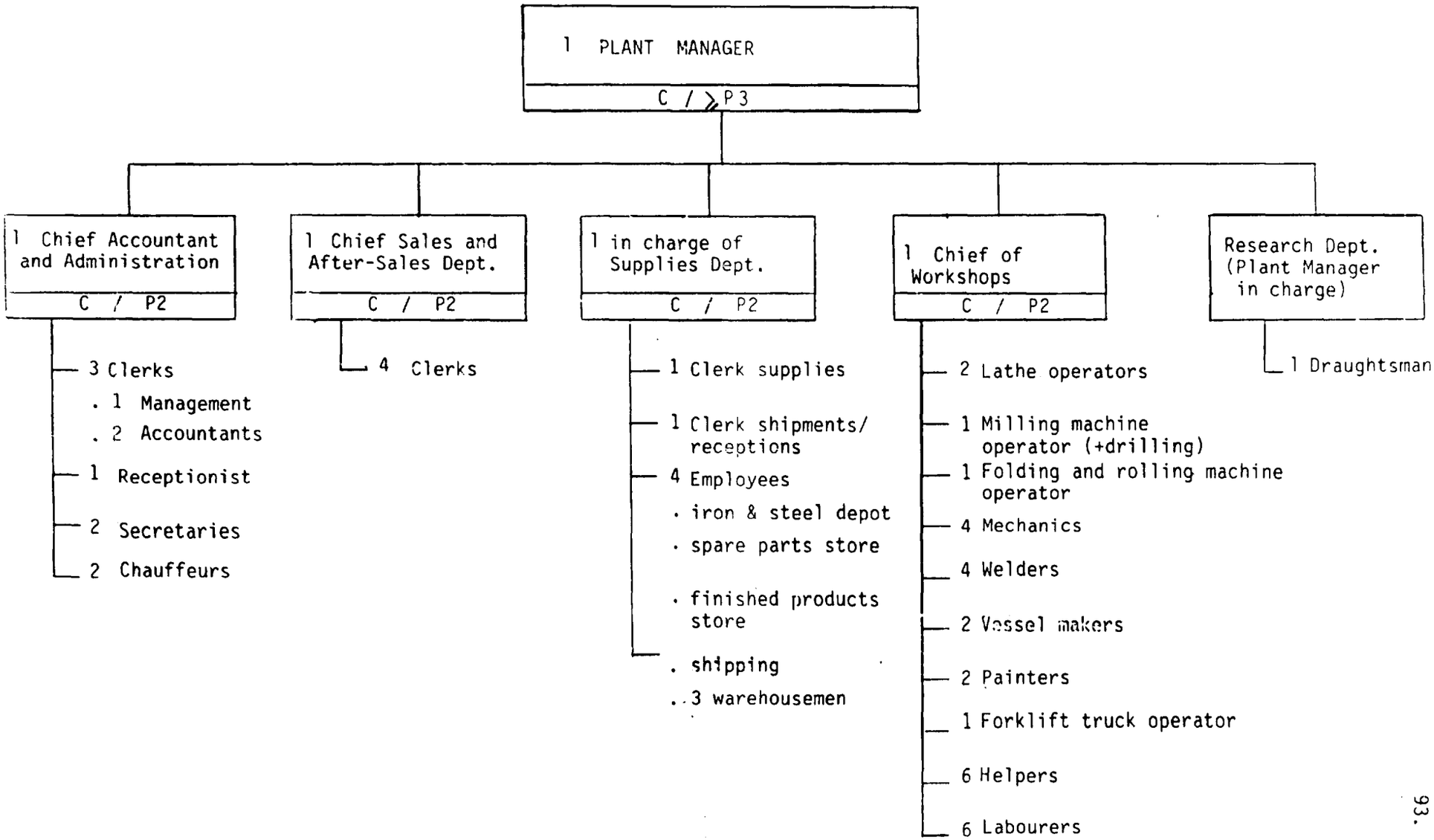


CHART OF ROLL AND COSTS OF PERSONNEL

m. o. = mach. operator
E = expatriate personnel
N = national personnel

Exhibit n° 8/1-4 ER - Plant in NIGER

DESIGNATION	Nb	E	N	CAT	Monthly salary (personnel)	Year 1 Yearly Salary	Year 2 Yearly Salary	Year 3 and over Yearly sal.	REMARKS
· Plant Manager	1	X				14 400	14.400		Expatriate detached for 2 years
	1		X	≥ P3 (HC)	669 170	8 030	8.030	8.030	
Secretary	2		X	6e	120 000	2 880	2.880	2.880	Office personnel
Receptionist	1		X	4e	99 200	1 190	1.190	1.190	Office personnel
· Chief Sales and After-sales Dept.	1		X	P2	350 000	4 200	4.200	4.200	Commercial side
Clerks After-sales dept	4		X	8e	150 000	6 000	6.000	6.000	Commercial side
· Chief Accountant	1		X	P2	370 800	4 450	4.450	4.450	Commercial side
Clerks personnel management & accounting	3		X	8e	170 000	5 100	5.100	5.100	Commercial side
· In charge of supplies department	1	X		P2		9 000	9.000		Expatriate detached for 2 years
	1		X	P2	350 000	4 200	4.200	4.200	Base technical education
Clerk supplies	1		X	8e	170 000	2 040	2.040	2.040	Technical education
Clerk ship./recept.	1		X	6e	143 300	1 719	1.719	1.719	Technical education
Employees stores: iron spare parts and finished products	3		X	4e	99 170	3 570	3.570	3.570	Industry side
Employee shipping	1		X	4e	99 170	1 190	1.190	1.190	Industry side
Warehousemen	3		X	2e	60 000	2 160	2.160	2.160	Industry side
Chauffeur	2		X	2e	90 000	2 160	2.160	2.160	
. Chief of worksnops	1	X		P2		9 000	9.000		Expatriate detached for 2 years
	1		X	P2	358 000	4 296	4.296	4.296	Technical education
-Lather operator	2		X	6e	125 000	3 000	3.000	3.000	Workshop personnel
-Milling/drilling m.o.	1		X	6e	125 000	1 500	1.500	1.500	
-Folding/rolling m.o.	1		X	6e	125 000	3 000	3.000	3.000	" "
-Mechanic	4		X	6e	125 000	6 000	6.000	6.000	" "
-Welder	4		X	6e	125 000	6 000	6.000	6.000	" "
-Vessel maker	2		X	6e	125 000	3 000	3.000	3.000	" "
-Painter	2		X	2e	90 000	2 160	2.160	2.160	" "
-Forklift truck oper.	1		X	2e	80 500	966	966	966	" "
-Helpers	6		X	2e	80 500	5 760	5.760	5.760	" "
-Labourers	6		X	1e	20 000	1 440	1.440	1.440	" "
· Draughtsman	1		X	M3	180 000	2 160	2.160	2.160	General mechanics side
1. Total cost in 000 F CFA						120 571	120 571	88 171	
2. Social Security contrib. 20 %						24 114	24 114	17 643	
3. Total 1 + 2 (in 000 F CFA)						144 685	144 685	105 805	

CHART OF ROLL AND COSTS OF PERSONNEL

m. o. = mach. operator
E = expatriate personnel
N = national personnel

Exhibit n°8/1-4 IA - Plant in NIGERIA

DESIGNATION	Nb	E	N	CAT				
· Plant Manager	1	X				28 800	28.800		Expatriate detached for 2 years
	1		X	17	1 625	19 500	19.500	19.500	
Secretary	2		X	6	270	6 480	6.480	6.480	Office personnel
Receptionist	1		X	5	216,6	2 600	2.600	2.600	Office personnel
· Chief Sales and After-sales Dept.	1		X	12	735	8 820	8.820	8.820	Commercial side
Clerks After-sales dept	4		X	7	325	15 600	15.600	15.600	Commercial side
· Chief Accountant	1		X	12	780	9 360	9.360	9.360	Commercial side
Clerks personnel management & accounting	3		X	7	346,6	12 478	12.478	12.478	Commercial side
· In charge of supplies department	1	X				18 000	18.000		Expatriate detached for 2 years
	1		X	12	735	8 820	8.820	8.820	Base technical education
Clerk supplies	1		X	8	325	3 900	3.900	3.900	Technical education
Clerk ship./recept.	1		X	7	335,8	4 030	4.030	4.030	Technical education
Employees stores: iron spare parts and finished products	3		X	5	216,6	7 800	7.800	2.166	Industry side
Employee shipping	1		X	5	216,6	2 600	2.600	2.600	Industry side
Warehousemen	3		X	3	162,5	5 850	5.850	5.850	Industry side
Chauffeur	2		X	5	208	5 000	5.000	5.000	
· Chief of workshops	1	X				18 000	18.000		Expatriate detached for 2 years
	1		X	12	760	9 120	9.120	9.120	Technical education
-Lather operator	2		X	6	280	6 720	6.720	6.720	Workshop personnel
-Milling/drilling m.o.	1		X	6	280	3 360	3.360	3.360	
-Folding/rolling m.o.	1		X	6	280	3 360	3.360	3.360	" "
-Mechanic	4		X	6	280	13 440	13.440	13.440	" "
-Welder	4		X	6	280	13 440	13.440	13.440	" "
-Vessel maker	2		X	6	280	6 720	6.720	6.720	" "
-Painter	2		X	4	217	5 200	5.200	5.200	" "
-Forklift truck oper.	1		X	4	195,8	2 350	2.350	2.350	" "
-Helpers	6		X	4	194,6	14 040	14.040	14.040	" "
-Labourers	6		X	1	137,5	9 900	9.900	9.900	" "
· Draughtsman	1		X	9	405,8	4 870	4.870	4.870	General mechanics side
1. Total cost in ₦						270 158	270 158	205 358	
2. Social Sec. contribution 20%						54 031	54 031	41 071	
3. Total 1 + 2 (in ₦)						324 189	324 189	246 429	

IX. IMPLEMENTATION SCHEDULE

. Chronogram

. Charts of costs of project implementation
(exhibits N° 9 ER and 9 IA)

A Total period of 17 months has been planned between the beginning of the the studies and the end of the setting-up and of the starting tests. This period includes 2 distinct phases :

A) A first project preparation phase during which will occur :

- the studies (2 months duration)
- preparation and launching of invitations to tender (duration 1 ½ months)
- analyses of offers and signing of orders (duration 1 ½ months)

During this first phase will take place the choice of the siting and the purchase of the land for the new plant.

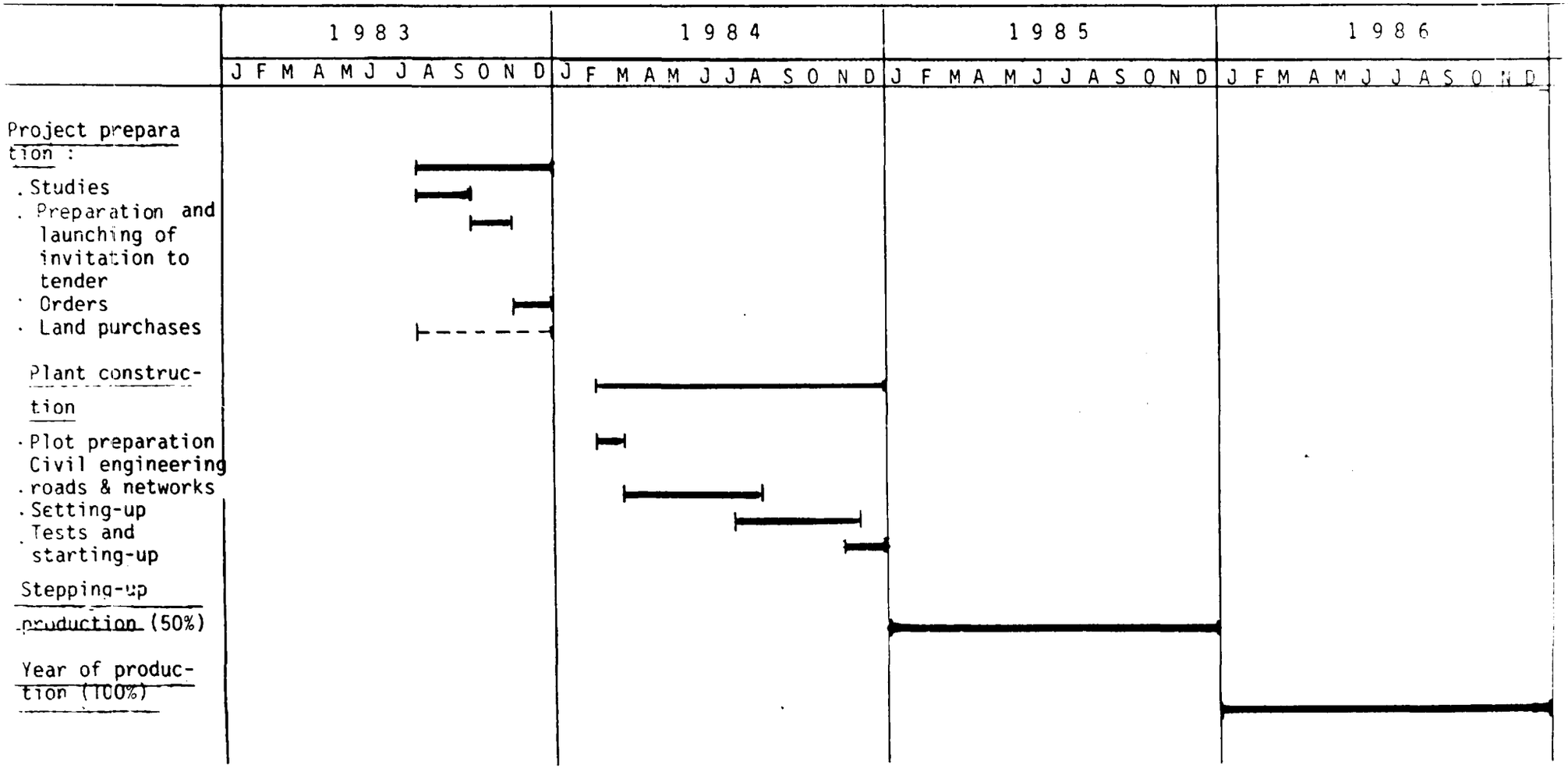
B) A second phase, corresponding to the projects realization will include :

- the preparation of the plot (duration 1 month)
- the realization of the civil work and of the lands. (duration 5 months)
- the setting-up of framework, roofings, aluminum coating and of the equipment, tests and starting-up (duration 5 ½ months).

It should be noticed that a time lapse of 1 ½ month separates the two phases; this delay should permit to finalize the first part's problems which remain pending and to prepare the second phase.

The first year after the starting-up will be a year during which production will be stepped up, with an average production of 50 % of a running year's at cruising speed. Such a production rather limited, we think it to be a realistic view, in consideration of the progressive implementation of the enterprise's management, of the build up of stocks and of the production personnel's training. The second year will be the year of full production, the above problems having progressively been eliminated.

IMPLEMENTATION SCHEDULE



SOFRECO

Exhibit 9 ER

N I G E R

ESTIMATE OF INVESTMENT COST

(IMPLEMENTATION OF PROJECT)

ESTIMATE OF INVESTMENT COST			
Implementation of project	Cost (000 CFA)		
DESIGNATION	Foreign Exchange	Local Currency	TOTAL
1. Direction of project implementation and detailed technical organization, invitations to tender	21.548	4.947	26.495
2. Control and coordination, tests and reception of civil engineering works, equipments and plant			(voir nota)
3. Setting-up of the administration, recruitment and training of staff and operating personnel	9.000	27.171	36.171
4. Organization of supply, and organization of marketing		4.206	4.206
5. Setting-up of links and legal fees.		2.653	2.653
6. Miscellaneous expenses, unforeseen		4.302	4.302
TOTAL	30.548	43.279	73.827

NOTA : The item N° 2 is included in the "Installation" chapter.

Exhibit 9 IA

N I G E R I A

ESTIMATE OF INVESTMENT COST
(IMPLEMENTATION OF PROJECT)

ESTIMATE OF INVESTMENT COST			
Implementation of project	Cost (in ₦)		
DESIGNATION	Foreign Exchange	Local Currency	TOTAL
1. Direction of project implementation and detailed technical organization, invitations to tender	43.066	9.923	52.989
2. Control and coordination, tests and reception of civil engineering works, equipments and plant			
3. Setting-up of the administration, recruitment and training of staff and operating personnel	20.167	60.880	81.047
4. Organization of supply, and organization of marketing		8.413	8.413
5. Setting-up of links and legal fees		5.404	5.404
6. Miscellaneous expenses, unforeseen		9.064	9.064
TOTAL ₦	63.233	93.684	156.917

NOTA : The item N° 2 is included in the "Installation" chapter.

X. FINANCIAL AND ECONOMIC EVALUATION

- Investments
- Financing
- Financial Analysis
- Socio economic evaluation
- Exhibits re : Study for plant in NIGER
  10-1/1, 10-1/2, 10-2/1, 10-2/2
  10-3/1, 10-3/2
  10-6/1, 10-6/2, 10-7/1, 10-7/2
  10-8/1, 10-8/2
  10-8/3, 10-9, 10-10
  10-11, 10-12, 10-13, 10-14,
  10-15
- Exhibits re : Study for plant in NIGERIA
  (same as above).

FINANCIAL AND ECONOMIC EVALUATION

1. INVESTMENTS :

The investments of the project include the permanent investments, the first establishment expenses and the working capital.

A. Permanent investments :

The permanent investments include : the purchase of land, the site preparation, the civil engineering and the buildings, the equipment.

For what concerns the land, the project requires a plot of about ½ hectare (5000 m^2) on which the built-up area will take about 1.050 m^2.

The land surface will eventually allow a doubling-up of the built-up area, and the development of storage areas in the open. In the implantation regions under consideration, the cost of such a plot is relatively low, and it has been indicated during the field inquiries that the land could be granted free of charge by public authorities. Therefore, we have not fixed any expense for the purchase of the land.

Preparation for the site has been evaluated on an inclusive basis, taking into consideration the fact that these zones did not show any particular difficulties, and that the plant's infrastructures are light. What will be need will be a scraping and a levelling of the land surface, after having chosen it as level as possible.

The civil engineering work and the buildings represent a little bit less than half of the initial permanent investment, the whole

of which for 60 % being of local origin. These elements have been described in chapter VI.

For the equipments and machines, consideration has been given to a purchase price referring to Europe, and to sea freight from Europe, and land transportation from port up to the implantation region. Installation and assembly expenses have been included in the total cost of equipments. It has been considered for the estimate that all the equipments and machines would be imported from overseas.

The total of the initial permanent investment amounts to 265,3 million F CFA for a Niger implantation and 540.494 ₦ for Nigeria implantation. (see charts 10-1/1 and 10-1/2)

The technical life expectancy for buildings is estimated at 20 years, and the one for equipments at 10 years. For the machines, this life expectancy is estimated at 10 years, for a working time of about 2.000 hours a year. Vehicles are expected to be replaced after 3 years.

The financial study of the project will therefore be limited to a 10 years period of operation, during which 2 vehicles replacement will take place.

The project is supposed to start in 1983, the year of preparation. The construction will take place over the whole of 1984, and operation will start in 1985, which will be the year of production stepping-up. The nine years between 1986 and 1994 will be years of running at cruising speed, i.e. at 100 % of the production programme as planned in this study. Vehicles will be replace in 1988, 1991 and 1994.

The calculation of the depreciation has been made on the basis of 20 years for the buildings and civil engineering works, 10 years for the equipments and the machines; for the vehicles, we have

considered 3 years in NIGER and 4 years in NIGERIA. The first establishment expenses are depreciated in 10 years.

B. First establishment expenses :

The first establishment expenses include the pre-investment studies, (estimated here at $ 60.000), the site study, the direction of execution and preparation of the invitation for tenders, the engineering study, the personnel's training, the organization of supply and marketing (0,5 % of sales) and the legal fees (1 % of the permanent investments).

In consideration of miscellaneous and unforeseen expenses of about 5 % of total, these first establishment expenses amount to 90,3 million F CFA in NIGER, or to 190.335 ₦ in NIGERIA (charts 10-2/1 and 10-2/2)

C. Working capital :

We have here a very important component of the project's financial structure. Calculations have been made taking into consideration the stocks required for a good operation of the process, the contraints of distance and markets, as weel as the usual delays for payments and collections.

The following standards have been set :

- proceeds from sales' collection	1 month
- stocks of rawstuff	4 months
- products in process	2 days
- finished products	½ month
- cash in hand	1 month
- accounts payable (credit accounts)	½ month

Stocks of rawstuff are built up for a rather long period (4 months)

since most of them shall in a first period be imported to be later on replaced by locally produced rawstuff.

For the finished products, stocks are limited to a half month production, on account of constraints holding to the planned area dedicated to storage, and because the middle men resalers will themselves do the financing of the stocks they will themselves hold in their stores.

Finished products stocks are evaluated, for the calculation of working capital, at their sales prices, in order to correct an over evaluation of sales as they figure in the chapter III charts.

The cash in hand has been calculated on basis of labor costs and overhead (1 month).

Notes payable are normally at one month, however, considering the transportation delays, they will in fact be at ½ month, i.e. the delay between the merchandises reception (in the plant) and payment to the importer will on the average be of ½ month.

Spare parts do not figure in the stocks, since the initial stock of them is included in the initial permanent investment.

The value of products in process corresponds to two days of production (on 230 days a year) on the basis of rawstuff and energy entering in the process.

All in all, the net working capital will amount to 204,5 million F CFA for the plant in NIGER and to 409.000 ₦ for the plant in NIGERIA (see charts 10-3/1 and 10-3/2).

D. Total of investment costs :

The total of the investment costs figure on charts 10-6/1 and 10-6/2, where have been put together the initial permanent investment, the first establishment expenses and the working capital. Chart 10-6/2 indicates the dividing up of all those investment expenses for the first five years of the project (1983 to 1987) Reinvestments for the replacement of vehicles, which should take place, in 1988, 1991 and 1994 do not figure on chart 10-6/2, but are included in chart 10-10 and 10/13-14.

Costs of investment amount to 560,2 Million F CFA for a plant in NIGER, with the folllowing dividing up in percentage :

- initial permanent investments : 47 %
- first establishment expenses : 16 %
- working capital : 37 %

For a plant in Nigeria, the total of investment costs amounts to 1.140.226 ₦, with about the same dividing up.

Charts 10-7/1 and 10-7/2 give the total of initial assets and their dividing up during the first five years. These charts differ from the preceding 10-6/1 and 10-6/2 charts only by the fact that they take into consideration the current assets instead of the net working capital.

2. FINANCING OF PROJECT :

The total of initial assets amounts to 574 million F CFA for the NIGER plant and to 1.167.000 ₦ for the NIGERIA project.

It should be noted that the financing requirements will not reach these figures. Actually the running assets formation will take place when the plant will start operating and thus will develop the project's capacity for self-financing.

On the whole, the financing needs will only be of about 410 million F CFA for the NIGER plant and of 853.000 ₦ for the NIGERIA plant.

In order to have a comfortable financial balance permitting to be protected from the effects of inflation during the investment period (on account of the unavoidable delay between the moment at which the funds are at disposal and their effective use), the financing requirements have finally been estimated at 440 million F CFA for the plant in NIGER and at 880.000 ₦ for that in NIGERIA.

Informations obtained in NIGER indicate that a medium term loan can be obtained at a 16% interest rate, with a two years period of grace, so that reimbursements will start only in 1986, when the plant will run at cruising speed. Under these conditions, the following financing scheme can be considered :

Financing through equity (authorized capital) (25%)	110 million F CFA
Medium term loan(s) (9 years)	330 million F CFA

Outpayments :

in 1984	270 million F CFA
in 1985	60 million F CFA

Repayments over 9 years :

1986 to 1993 (8 years)	40 million F CFA a year
1994	10 million F CFA

Interests (nominal rate 16 %)

1987	46,4	million F CFA
1988	40,0	
1989	33,6	
1990	27,2	
1991	20,8	
1992	14,4	
1993	8,1	
1994	1,6	

The loan's actuarial rate comes out at 12,73 %. The payment of capital will take place in 1983 and 1984, for an amount of :

40 million F CFA in 1983
and 70 million F CFA in 1984

Charts 10-8/1 and 10-8/2 indicate the sources of financing and the dividing up of financing for the project's first years. It is supposed that the capital will be provided by the national developer(s) up to 60 million F CFA and by the foreign associate(s) up to 50 million F CFA.

The medium term loan will for the largest part be used to cover investment expenses in foreign exchange (up to 250 million F CFA), and for the remainder (80 Million F CFA) for expenses in local currency.

Chart 10-8/3 gives a general outlook of the financial movements in the project, considering the above financing hypothesis. With it can be calculated for each year of the project's life the financial balance, and thus to check that it is always solvent, i.e. that the cumulated financial balance be always positive. In fact the project is a little overfinanced, in order to ensure its solvency, even in the case of inflation during the investment period. Chart 10-8/3 gives already an interesting indication on the profitability of the project, which here seems very good, since the cumulated financial balance reaches a significant amount. In the absence of precise indications in the matter, the supposed financing scheme does not plan giving statutory dividends; the finanical balance therefore could be shared between the developer(s) and the associate(s) according to forms negotiated between them.

For the plant in NIGERIA, the general financing outline would be the same, but the values would be given in ₦, and the medium term loan's conditions would be different. The loan would be of an amount of 660.000 ₦, with a nominal rate of 8 %, with a delay of 2 years before starting the repayments, but with a 1 % a year engagement commission.

The schedule would be the following :

	Outpayments	Repayments	Interests
1984	540.000		
1985	120.000		
1986		80.000	52.800
1987		80.000	46.400
1988		80.000	40.000
1989		80.000	33.600
1990		80.000	27.200
1991		80.000	20.800
1992		80.000	14.400
1993		80.000	8.000
1994		20.000	1.600

With the first payment of interests, would be added the commission, the total of which being of ₦ 12.000 (540.000 x 2 years x 1 % plus 120.000 x 1 year x 1 %). The loan's actuarial rate appears at 6,93%.

3. FINANCIAL ANALYSIS OF PROJECT :

A) Net profit :

With chart 10-9 can be calculated the projects net profit. The difference between the revenue of sales and the costs of production is the gross profit, i.e. the taxable profit.

Income tax is calculated according to the schedules effective in the lands of implantation. In NIGER, the level of taxes would be of 50 % according to the information we gathered, in NIGERIA, this level would be of 45 %. The gross profit/sales, net profit/sales and net profit/investment ratios show a high profitability.

B) Balance sheet projection :

This favourable impression is confirmed by chart 10-10, which shows the balance sheet projection year after year, and which presents a strong progression of the project's reserves. The financial structure of the projects seems very good, and capable of comforting the money lenders.

C) Total cost of production :

The total cost of production includes the operating expenses, the financial expenses (the interest payments) and depreciation. Computation of the total cost of production is given in charts 10-11 and 10-12. Chart 10-12 is limited to the three first years of production 1985, 1986 and 1987 since afterwards all figures remain the same, except the interest payments, which decrease every year until 1994, year .. the last payment as such.

D) Break even point :

The calculation of the break even point is made according to the formula :

$$\frac{\text{Fixed costs}}{\text{Sales earnings - variable costs}}$$

The calculation shows that the project is very interesting and shows relatively little risk, with a break even point much under 50 % of the planned production programme. In order to do this calculation, it is necessary to separate the fixed from the variable costs in the total cost of production.

For the NIGER plant, the total cost of production for 1987 is broken down as follows :

Total cost of production (1987) :		570.348.000 F CFA
of which : fixed costs :		190.194.000 F CFA
- depreciation	32.767.000	
- interests	46.400.000	
- manpower	105.805.000	
- overhead	5.222.000	
Variable costs (proportional)		380.154.000
- rawstuff	329.676.000	
- sales and distribution expenses	50.478.000	

For the calculation of the break even point, will be considered the fixed costs less the interests.

Break even point :

$$\frac{143.794.000}{841.301.000 - 380.154.000} = \frac{143.794}{461.147} = 0,312$$

i.e. 31 % of the planned production programme. If the interests, were added to the fixed costs (46.400.000 F CFA in 1987) the break even point would still be at 41 %. Thus the project enjoys here a good safety margin :

For the plant in NIGERIA, the figures would be the following (year 1987) :

Sales earnings		: ₦ 1.682.602
Variable operating expenses (proportional)		: ₦ 650.575
Fixed costs : manpower	₦ 246.429	
overhead	₦ 11.462	
depreciation	₦ 63.262	
	₦ 321.153	

Break even point :

$$\frac{321.153}{1.682.602 - 650.575} = \frac{321.153}{1.032.027} = 0,311 \quad \text{i.e. } 31\ \%$$

We find almost the same figure for the two implantations under consideration.

4. PROJECT ACTUALIZED VALUE :

Chart 10-13 indicates the earnings and expenses of the project, in the absence of outside financing besides the enterprise. It permits the calculation of the internal profitability of the project and thus to check whether the project has a sufficient profitability to be financed by normal channels.

Since the period under consideration totals 13 years, i.e. : a first year (1983) preparation, a second year (1984) construction a year of stepping up of production (1985), nine years of full production (1986 to 1994) and one year of fictitious project liquidation (1995).

The ten years operating period (1985 to 1994) corresponds to the life expectancy of the largest part of the production equipment, especially the machines, important replacements having to be planned after that delay, i.e. from 1995 onwards. The project being stopped in 1995 in order to make the evaluation, the fixed assets not fully depreciated have been given a residual value, more or less arbitrary since it is the one that remains after financial accounting depreciation.

For the NIGER plant, the retained residual value is of 64.772.000 F CFA (i.e. 61.427.000 F CFA for the buildings and 3.345.000 FCFA for the vehicles purchased in 1994) to which should be added the total value of the working capital to wit : 204.504.000 F CFA. The obtained cash flow after a 50 % tax on taxable income (net of depreciation) shows an internal profitability level of almost 29 %, which is highly favorable . This means that the project could get a loan at the rate of 16 %, rate applied by the Banque pour le Developpement de la République du Niger (BDRN) for small projects; this rate includes the tax collected by the state.

Chart 10-14 shows the financial movements in the project, in consideration of the proposed financing scheme. This is at the level of 16 %, with repayment and interest payments which lead to an actuarial level of 12,73 %.

The new project's cash flow, after this financing hypothesis, indicates a return on investment (on the enterprises own funds of about 55 %, which is highly favourable for the project's owners).

For the plant in NIGERIA, the residual value of the investment is estimated at ₦ 140.350, including the buildings' part for ₦ 134.330 and the vehicles for ₦ 6.020. The total working capital's recovery brings ₦ 409.397. The cash flow obtained (chart 10-13) after 45% income tax on taxable income (see chart 10-9) indicates an internal rate of return level of almost 29 %, practically the same as the one obtained for the other implantation. Since the loan is at a nominal rate of 8 % (actuarial rate 6,93%) the return on investment is even higher. Actually, the 10-14 chart lets a return on investment be calculated at a level of about 56 %.

To conclude, the project is highly interesting on the financial side, its profitability is high and the evaluations' results are almost identical for both the locations studies here.

5. SOCIO ECONOMIC EVALUATION :

Under this heading will be considered the project's effects on employment, on the distribution of income in the frontier region, on the collection of taxes and on the foreign exchange balance. Will also be noted the creation of added value and the benefits for the end-users.

Effects on employment :

The project will create jobs in the border zone. List of these jobs figures in chapter VIII. Except the 3 foreign specialists planned for the first two years of operation, the personnel of national or local origin will be of 56 persons, and the salaries paid out to them will amount to 88.171.000 F CFA or ₦ 205.358 yearly.

The relation between the initial permanent investment and the number of created workposts indicate the initial investment for each workpost, which is here of :

$$\frac{865.303.000}{56} = 4.737.554 \text{ F CFA}$$

$$\frac{540.494}{56} = 9.652 \text{ Nairas}$$

It should be noted that, with an exchange rate of 500 F CFA for 1 Naïra, the difference in initial permanent investment for each workpost, between a NIGER and a NIGERIA implantation is only of 2 %. This project is moderately capitalistic and represents a type of medium size industry suitable to further the industrial development of the border zone.

Effects on the incomes in the region :

The projects will provide an interesting distribution of income in the region. First, in the investment stage :

Initial permanent investment	103.504.000 F CFA or	₦ 266.438
First establishment expenses	44.131.000 F CFA or	₦ 95.503
Total :	147.635.000 F CFA	₦ 361.941

Then, for every year of operation :

Salaries	89.171.000 F CFA or	205.358 ₦
Social benefits	17.643.000 F CFA or	41.071 ₦
Total :	105.804.000 F CFA or	246.429 ₦

Therefore, the project will contribute efficiently to an increase of revenues in the border zone.

Creation of added value :

In a year at cruising speed, the directly added value created by the project will be :

Sales :	841.301.000 F CFA	or	1.682.602 ₦
less purchases of rawstuff	329.676.000 F CFA	or	650.575 ₦
Directly added value	511.625.000 F CFA	or	1.032.027 ₦

To this direct added value should be added the indirect added value corresponding to the national purchases of material and services, which will be of :

100.359.000 F CFA or 209.686 ₦

To the above should further be added, later on, the replacement of part of the expenses in foreign exchange by national sources of material and services. If half of those expenses paid in foreign exchange were replaced in this manner, a supplementary indirect added value of :

142.533.000 F CFA or 276.653 ₦

would be obtained.

The total added value eventually obtained would amount to : 754.517.000 F CFA or 1.518.366 ₦ a year.

Compared with :

a) the initial investment :

$$\frac{754.517.000}{265.303.000} = 2,84 \quad \text{or} \quad \frac{1.518.366}{540.494} = 2,81$$

b) the manpower costs :

$$\frac{754.517.000}{105.805.000} = 7,13 \quad \text{or} \quad \frac{1.518.366}{246.429} = 6,16$$

c) to the number of workposts :

$$\frac{754.517.000}{56} = 13.474.000 \text{ F CFA} \quad \text{or} \quad \frac{1.518.366}{56} = 27.114 \text{ ₦}$$

The ratios obtained show that the project will contribute very efficiently to an increase of the national income and therefore to the local income.

Effect on the taxes collected :

The yearly losses in taxes collected corresponding to the duty paid on the mills and spare parts which will not anymore be imported will in great part be compensated by direct gains in taxes, due to corporate taxes (on the firms's profits) and to the taxes and custom duties paid on the material and equipment used for the project. If to those are added the indirect gains in income and other taxes paid, under the form of income tax or taxes on the increased consumption created by the project, then the balance will be positive. The calculation is the following :

- Yearly loss in tax collection (20 % of value of sales) :
  168.260.000 F CFA or 336.520 ₦

- Corporate taxes (average for 9 years) :
  142.906.000 F CFA or 257.735 ₦

Indirect gains in taxes collected (5 % of income) :
10.868.000 F CFA or 23.368 ₦

On the whole, the project will have as an effect an increase in taxes collected, even without any consideration for the secondary effects obtained by way of the industrial development (investment multiplier).

Savings in foreign exchange :

The project's purpose being mainly the substitution of a local production to imports, it is interesting to consider the effect of the project on the (foreign exchange balance).

For that purpose, will be computed successively :

a) the gross savings in foreign exchange, equivalent to the CAF value of the replaced imports, here, as a rough approach, estimated at the sales worth of the project.

b) the use of foreign exchange for the investment and the operation.

c) credits obtained in foreign exchange, and later on, their back payment, and the interests paid out.

d) the net savings in foreign exchange induced by the project :
d = (a) - (b) - (c)

Can be later considered the national resources used in the project to obtain these net savings in foreign exchange, in order to have an estimate of the project's productivity and competitiveness.

Calculations figure on charts 10-16 NIGER and 10-16 NIGERIA.
Considering a social rate of actualization of 12 %, the actualized

value of the net savings in foreign exchange in 10 years of operations is equivalent to 2,3 billion F CFA or 4,9 million ₦, at the official rates of exchange. National resources used to obtain these net savings in foreign exchange have only a value of 1,2 billion F CFA Or 2,8 million ₦. The project will therefore produce savings in foreign exchange, with the use of national resources, at a very favourable rate of exchange, much better than tne official rates.

Advantages for the end-users :

The locally produced mills will be offered at a price 20 % below the price of similar imported models.

Moreover, through the creation of a source of available spare parts in the region, the project will have important repercussions on the use of existing mills, by the suppression or the reduction of the waiting period for those parts, which will avoid the periods when those mills do not work well or do not work at all.

These considerations lead to the idea that the project will contribute positively to the development of the concerned national economies, and in particular to the development of the border zone, and that it will be equally beneficial, that it be set in NIGER or in NIGERIA.

It does not seem possible to play on the monetary differences to determine a preference for one implantation rather than for another. Actually, even though the NAIRA had generally been considered as overvalued versus the CFA franc at the official rate in 1982, it has increased since then. This shows the difficulty of estimating the respective values of two currencies in real terms. All in all, this value may be quite near the official rate of exchange.

CHAPTER X

EXHIBITS STUDY FOR PLANT IN NIGER

EXHIBITS 10-1/1 AND 10-1/2

COSTS OF INITIAL PERMANENT INVESTMENTS (IN 000 CFA)

(see text pages 102-103)

Item	Investment category	Chapter source	Foreign Exchange	Local Currency	Total cost
1.	Land	5.1	For the record		
2.	Site preparation and lay-out	6.7		5 000	5 000
3.	Structures and civil engineering work				
	a) Buildings and civil engineering works	6.7	45 120	67 680	112 800
	b) Auxiliary installations and services	6.7		8 400	8 400
4.	Incorporeal investments	6.1	(see nota)		
5.	Vehicles		15.051		15.051
6.	Machines and equipment installation	6.3	101 628	22 424	124 052
7.	Total cost of initial permanent investments		161 799	103 504	265 303

NOTA : .Item 4 - the use of licences is included in the operating expenses (royalties proportional to sales).

.Chart 10-1/2 is associated to chart 10-1/1 since all the investment takes place within the same year.(1984).

EXHIBITS 10-1/2 FIRST ESTABLISHMENT EXPENDITURES, PRIOR TO PRODUCTION
(see text pages 103 and 104) (000 CFA)

Item	Category	Source	Foreign Exchange	Local Currency	Total
1.	Preinvestment studies	Exh. 2.1	13 752		13 752
2.	Preliminary research	2.1	1 917	852	2 769
3.	Direction of project's implementation	9.1	21 548	4 947	26 495
4.	Detailed planning, invitations to tender	9.1			
5.	Control, coordination testing and reception of civil engineering works, equipment and installations	9.1	(see Nota)		
6.	Set-up of the management recruitment and training of supervisory and operating personnel	9.1	9 000	27 171	36 171
7.	Organization of supply	9.1		4 206	4 206
8.	Organization of marketing	9.1			
9.	Set-up of connections, legal expenses	9.1		2 653	2 653
10.	Varied and unexpected expenses	9.1		4 302	4 302
	TOTAL		46 217	44 131	90 348

NOTA : Item 5 - included in installations.

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EXHIBIT 10-2/2 : FIRST ESTABLISHMENT EXPENDITURES, PRIOR TO PRODUCTION PER ANNUM

(see text page 104)

Period	Preparation			Construction			TOTAL		
Year	1983			1984					
Financing (in 000 F CFA)	D	L	T	D	L	T	D	L	T
First establishment expenditures	28317	7196	35513	17900	36935	54835	46217	44131	90348

NOTE : D = Foreign exchange ; L = Local currency ; T = TOTAL

EXHIBITS - 3/1 & 10 - 3/2

CALCULATION OF WORKING CAPITAL REQUIREMENT

(see text page 104)

I T E M	Minimum period to cover	Ratio to turnover	Necessary funds (thousands of CFA)		
			Starting years	Years of running at cruising speed	
			1985	1986	1987 and >
1. Circulating assets (Current assets)	1 month	12	35.054	70.108	70.108
A. Accounts receivable					
B. Stocks					
a) Rawstuff	4 months	3	50.479	100.959	100.959
b) Spare parts	See	NOTA			
c) Production in progress	2 days	115	1.433	2.867	2.867
d) Finished products	½ month	24	17.527	35.054	35.054
C. Cash in hand	1 month	12	12.492	12.492	9.252
D. Circulating assets (A + B + C)			116.985	221.480	218.240
2. Running liabilities					
. Accounts payable	½ month	24	6.868	13.736	13.736
3. Working capital					
. Net working capital			110.117	207.744	204.504
. Increase of working capital			110.117	97.627	- 3.240

NOTA : Item a - The rawstuffs are supposed to be all imported in a first period Later on, they will be replaced by local products.

Item b - The spare parts are included in the initial investment.

EXHIBIT 10-6/1 . SUM OF INITIAL INVESTMENT EXPENDITURES

(see text pages 105 - 106)

Item : Category of investment	Foreign Exchange (in 000 F CFA)	Local currency	TOTAL (000 CFA)
1. Cost of initial permanent investments (source exh. 10-1/1)	161 799	103 504	265 303
2. First establishment expenditures (Source : exhibit 10-2/1)	46 217	44 131	90 348
3. Working capital (year at cruising speed) (Source : exh. 10-3/2, 3rd year § 3)	100 950	103 545	204 504
	308 975	251 180	560 155

NOTA : Working capital foreign exchange = imported rawstuffs

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EXHIBIT 10-6/2 . TOTAL OF INVESTMENT COSTS

(see text page 106)

Period	Preparation			Construction			Start-up			Work at cruising speed						TOTAL (000) CFA		
Year	1983			1984			1985			1986			1987					
Financing (000 F CFA)	D	L	T	D	L	T	D	L	T	D	L	T	D	L	T	D	L	T
Cost of initial permanent investments				161799	103504	265303										161799	103504	265303
First establishment expenses (source exhibit 10-2/2)	28317	7196	35513	17900	36935	54835										46217	44131	90348
Increase of working capital source exh. 10-3/2 § 3							50479	59638	110117	50480	47147	97627	0	-3240	-3240	100959	103545	204504
Total cost of investm.	28317	7196	35513	179699	140439	320138	50479	59638	110117	50480	47147	97627	0	-3240	-3240	308975	251180	560155

NOTA : Reinvestments in 1988/1991 and 1994 do not figure in this chart which bears only on the first 5 years. These reinvestments figure on combined chart 10-13/10-14

EXHIBIT 10.7/1 - TOTAL OF INITIAL ASSETS

(see text page 106)

Item : category of investment	Foreign Exchange	Local Currency	TOTAL (000 CFA)
1. Cost of initial permanent investments (source : exh.10-1/1)	161.799	103.504	265.303
2. First establishment expenditures (source : exhibit 10-2/1)	46.217	44.131	90.348
3. Circulating assets (at full capacity) (source exhibit 10-3/2 3rd year § 1D)	100.959	117.281	298.240
TOTAL	308.975	264.916	573.891

N I G E R

EXHIBIT : 10 - 7/2 : TOTAL OF ASSETS

(see text pages 106-107)

PERIOD	PREPARATION			CONSTRUCTION			START-UP			WORK AT CRUISING SPEED								
YEAR	1983			1984			1985			1986			1987					
FINANCING (000 CFA)	D	L	T	D	L	T	D	L	T	D	L	T	D	L	T	D		
Cost of initial permanent investments				161799	103504	265303										161799	103504	265303
First establishment expenses (source exhibit 10-2/2)	28317	7196	35513	17900	36935	54835										46217	44131	90348
Increase of circulating assets (source : exhibit 10-3/2)							50479	66506	116985	50480	54015	104495	0	-3240	-3240	100959	117281	218240
TOTAL OF ASSETS	28317	7196	35513	179699	140439	320138	50479	66506	116985	50480	54015	104495	0	-3240	-3240	308975	264916	573891

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EXHIBIT 10-8/1 - SOURCES OF FINANCING

(see text page 108)

Sources of financing	Local currency	Foreign Exchange	TOTAL (000 CFA)
1. Developers			
- ordinary shares	60.000		60.000
2. Associates			
- ordinary shares		50.000	50.000
3. Financial institutions or development organizations :			
- Loans	80.000	250.000	330.000
4. State			
5. Commercial banks			
6. Public bonds			
7. Credit by suppliers			
8. Running liabilities (rounded off)		14.000	14.000
TOTAL all items	140.000	314.000	454.000

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EXHIBIT 10-8/2 SOURCE OF INITIAL FINANCING

(see text page 108)

Period	Preparation			Construction			Start-up			Work at cruising speed			TOTAL (en 000 CFA)		
Year	1983			1984			1985			1986					
Financing (000 FCFA)	D	L	T	D	L	T	D	L	T	D	L	T	D	L	T
Ordinary shares		40.000	40.000	50.000	20.000	70.000							50.000	60.000	110.000
Loans				190.000	80.000	270.000	60.000		60.000				250.000	80.000	330.000
Running liabilities (rounded off)							7.000		7.000	7.000		7.000	14.000		14.000
TOTAUX	0	40.000	40.000	240.000	100.000	340.000	67.000		67.000	7.000		7.000	314.000	140.000	454.000

NOTE D = Foreign exchange, L = Local currency, T = total.

EXHIBIT No 3 - PERIOD OF EXPLOITATION FOR FINANCIAL PLANNING

(See paper 10% & 10 9)

Period	Preparatory study	Execution	Starting up	PLANT IN OPERATION AT CRUISING SPEED									Year of liquidation
Year	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Production programme (source : exhib.3-3)	0	0	50	100	100	100	100	100	100 %	100 %	100 %	100 %	
Costs (in F CFA)													
A. Cash incomes	40 000	340 000	487 518	848 169	841 301	841 301	841 301	841 301	841 301	841 301	841 301	841 301	(13736)
1. Total of financial resources (source : exhibit 10-8/2)	40 000	340 000	66 868	6 868									
2. Product of sales (source : exh. 3-1)			420 650	841 301	841 301	841 301	841 301	841 301	841 301	841 301	841 301	841 301	
B. Cash expenditures	35 513	320 138	480 918	840 293	709 813	714 875	706 658	703 458	705 275	697 058	693 858	665 675	
1. Constitution of total assets, including replacement. (source : 10-7/2)	35 513	320 138	116 985	104 495	- 3240	5 017			5 017			5 017	(283012)
2. Operating expenses (source : exh. 10-12)			339 984	530 061	491 181	491 181	491 181	491 481	491 181	491 181	491 181	491 181	
3. Loans reimbursements :													
a) interests :													
Bank loans				53 000	46 400	40 000	33 600	27 200	20 800	14 400	8 000	1 600	
b) Reimbursements													
Bank loans				40 000	40 000	40 000	40 000	40 000	40 000	40 000	40 000	10 000	
4.Corporate taxes (source : exh. 10-9)			23 949	112 737	135 477	138 677	141 877	145 077	148 277	151 477	151 677	157 877	
C. Surplus or deficit	4 487	19 862	6 600	7 876	131 483	126 426	134 643	137 843	136 026	144 243	147 443	175 626	269 276
D. Accrued cashflow	4 487	24 349	30 949	38 825	170 308	296 734	431 377	569 220	705 246	849 489	996 932	1 172 558	1 441 834

NOTA : Item A-1 includes accounts payable of the working capital Item B-5 : there is no statuary dividend at this stage of the study
Item B-1 year 1995 : half of the redeemable in 20 years assets + 1/3 of renayment of 1994 (vehicles).
Item C-1 year 1995 : liquidation of credit account of working capital.

EXHIBIT 10-9 SCHEDULE OF NET INCOME

(see text page 110)

Period	Preparation	Construction	Starting-up	Cruising speed	
Year	1983	1984	1985	1986	1987
Production programme			50 %	100 %	100
Costs (000 F CFA)					
1. Sales			420.650	841.301	841.301
2. Production costs			372.751	615.828	570.348
3. Gross or taxable income (1-2)			47.899	225.473	270.953
4. Taxes			23.949	112.736	135.477
5. Net income (3 - 4)			23.950	112.736	135.477
6. Retained profit			23.950	112.737	135.477
7. Accrued retained profits			23.950	136.687	272.164
8. Ratios :					
Gross income : sales (%)				26,8	32,2
Net income : sales (%)				13,4	16,1
Net income : equity (%)				102	123

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PIECE 10-10 . PROJECTED BALANCE SHEET

(see text page 109)

Period	Prepara-tion	Construc-tion	Starting-up	Cruising Speed								
Year	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	199
A. Assets (total)												
1. Running assets (accrued total)	40 000	380 000	470 818	550 422	645 900	744 574	846 450	951 526	1059802	1171 278	1285 954	1 433
a) Cash balance (source: exhibit 10-8/3)	4 487	24 349	30 949	38 825	170 308	296 734	431 377	569 220	705 246	849 489	996 932	1 172
b) Circulating assets (Source exhibit 10-3/2)			116 985	221 480	218 240	218 240	218 240	218 240	218 240	218 240	218 240	218
2. Permanent assets (after depreciation) Initial permanent investments, replacements and first establishment expenses	35 513	355 651	322 884	290 117	257 350	229 600	196 833	164 066	136 316	103 549	70 782	43
B. Liabilities (total)	40 000	380 000	470 818	550 422	645 900	744 574	846 450	951 526	1059 802	1171 278	1285 954	1433
1. Running liabilities			6 868	13 736	13 736	13 736	13 736	13 736	13 736	13 736	13 736	13
2. Short and medium term loans		270 000	330 000	290 000	250 000	210 000	170 000	130 000	90 000	50 000	10 000	0
3. Capital	40 000	110 000	110 000	110 000	110 000	110 000	110 000	110 000	110 000	110 000	110 000	110
4. Reserves (source : exhibit 10-9 line 7)			23 950	136 687	272 164	410 838	552 714	697 790	846 066	997 542	1152 218	1310

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EXHIBIT 10-11 TOTAL COST OF PRODUCTION IN A YEAR AT CRUISING SPEED (YEAR 1987)

(see text pages 110 - 111)

000 CFA

I T E M	Foreign Exchange	Local Currency	TOTAL
1. Material and direct production factors (source : exh. 4-2)	238.795	90.881	329.676
2. Direct manpower operating and supervisory personnel (source : exhibit 8-2 & 8-4)		105.805	105.805
3/4 Overhead		5.222	5.222
5. Marketing expenses	46.272	4.206	50.478
Operating costs (1+2+3+4+5)	285.067	206.114	491.181
6. Financial overhead (source : chap X)	35.152	11.248	46.400
7. Depreciation		32.767	32.767
TOTAL of cost of production	320.219	250.129	570.348

NIGER

EXHIBIT 10-12 SPREADING OF COSTS OF PRODUCTION

(see text pages 110 - 111)

Period	Starting-up			Working at cruising speed					
Year	1985			1986			1987		
Production programme	50 %			100 %			100 %		
Financing (in 000 F CFA)	D	L	T	D	L	T	D	L	T
1. Direct material	119397	45441	164838	238795	90881	329676	238795	90881	329676
2. Direct manpower		144685	144685		144685	144685		105805	105805
3. Plant and administration overhead		5222	5222		5222	5222		5222	5222
Production expenses (1 + 2 + 3 + 4)	119397	195348	314745	238795	240788	479583	238795	201908	440703
4. Sales and marketing expenses :	23136	2103	25239	46272	4206	50478	46272	4206	50478
Operating expenses (1 + 2 + 3 + 4)	142533	197451	339984	285067	244994	530061	285067	206114	491181
5. Financial costs	0	0	0	40147	12853	53000	35152	11248	46400
6. Depreciation		32767	32767		32767	32767		32767	32767
Total of costs of production (1+2+3+4+ 5+6)	142533	230218	372751	325214	290614	615828	320219	250129	570348

NOTE D = Foreign exchange , L = Local currency, T = total.

EXHIBIT 10-13 : CHART OF CASH-FLOWS AND CALCULATION OF NET PRESENT VALUE IN THE CASE OF A PROJECT RECEIVING 25 % FINANCING

(See text pages 113, 114)

Period	Set up		Starting-up		Working at cruising speed								Liquidation value
Year	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Production programme (source : exh. 3-3)	0	0	50 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	
Value (000 F CFA)													
A. Cash incomes													
1. Total of sales (source exhib.3-1)			420 650	841 301	841 301	841 301	841 301	841 301	841 301	841 301	841 301	841 301	
B. Cash expenditures (1+2+3)	35 513	320 328	474 050	766 925	646 618	654 875	649 858	649 858	654 875	649 858	649 858	654 875	(269.276)
1. Total investment expenses (source exhib.10-6/2	35 513	320 328	110 117	97 627	- 3240	5 017			5 017			5 017	
2. Operating expenses (source : exh.10- 12)			339 984	530 061	491 181	491 181	491 181	491 181	491 181	491 181	491 181	491 181	
3. Corporate taxes			23 949	139 237	158 677	158 677	158 677	158 677	158 677	158 677	158 677	158 677	
C. Net cashflow (A - B)	-35 513	-320 138	- 53 400	74 376	194 683	186 426	191 443	191 443	186 426	191 443	191 443	186 426	(269 276)
D. Actualized value													
E. Net accrued cashflow	-35 513	- 355 651	-409 051	-334 675	-139 992	46 434	237 877	429 320	615 746	807 189	998 632	1185 058	1454 334

NOTA : Item D the internal yield ratio calculated by machine is of about 29 %

. - Liquidation value :
- Land, no value : nil
- Buildings, half value : 63.100
- Working capital : 267.604
- Vehicle 1/3 value : 1.672

EXHIBIT : CHART OF FLOWS AND CALCULATION OF ACTUALIZED VALUE
IN THE CASE OF A PROJECT GETTING SOME EXTERIOR FINANCING

(See page 114)

Period	Preparation	Construction	Starting up	Working at cruising speed									Liquidation value
Year	1983	1984	1985	1986	1987	1983	1989	1990	1991	1992	1993	1994	1995
Production programme source : exh. 3-3	0	0	50 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	
Value (000 F CFA)													
A. Cash incomes													
1. Total of sales (source : exh. 3-1)			420 650	841 301	841 301	841 301	841 301	841 301	841 301	841 301	841 301	841 301	
B.Cash expenditures													
1. Total investment expenses (permanent investm.)	35 513	50 138	50 117	190 627	83 160	85 017	73 600	67 200	65 817	54 400	48 000	16 617	(269 276)
a) Capital	35 513	50 138	50 117	97 627	(-3240)								
b) Replacement of vehicles(source exhibit 10-8/2)						5 017			5 017			5 017	
c) Loan reimbursemt.				40 000	40 000	40 000	40 000	40 000	40 000	40 000	40 000	10 000	
d) Loan interests				53 000	46 400	40 000	33 600	27 200	20 800	14 400	8 000	1 600	
2. Working expenses (Source exhibit 10- 12)			339 984	530 061	491 181	491 181	491 181	491 181	491 181	491 181	491 181	491 181	
3.Corporate taxes (source :exhibit10-9			23 949	112 737	135 477	138 677	141 877	145 077	148 277	151 477	154 677	157 877	
C.Net cashflow (A-B)	-35 513	-50 138	6 600	7 876	131 483	126 426	134 643	137 843	136 026	144 243	147 443	175 626	(259 276)
D.Actualized value (a)													

(a) Rate of internal return : 55 %

N I G E R

EXHIBIT 10-15 SUMMARY STATEMENT FOR A PLANT IN NIGER

PLANT in NIGER (000 F C F A)	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Product of sales			420.650	841.301	841.301	841.301	841.301	841.301	841.301	841.301	841.301	841.301	
Total administrat. expenses													
Permanent investments		265.303				5.017			5.017			5.017	64.772
First establishment expenses	35.513	54.835											
Working capital			110.117	97.627	- 3.240								204.504
Operating expenses			339.984	530.061	491.181	491.181	491.181	491.181	491.181	491.181	491.181	491.181	491.181
Corporate taxes			23.949	139.237	158.677	158.677	158.677	158.677	158.677	158.677	158.677	158.677	
Cashflow (10-13)	- 35.513	- 320.138	- 54.400	74.376	194.683	186.426	191.443	191.443	186.426	191.443	191.443	186.426	269.276
Accrued	- 35.513	- 355.651	- 409.051	- 334.675	- 139.992	46.434	237.877	429.320	615.746	807.189	998.632	1.185.058	-
Loan		270.000	60.000										
Reimbursement				40.000	40.000	40.000	40.000	40.000	40.000	40.000	40.000	10.000	
Interest (15 %)				53.000	46.400	40.000	33.600	27.200	20.800	14.400	8.000	1.600	
Taxes correction				26.500	23.200	20.000	16.800	13.600	10.400	7.200	4.000	800	
Cashflow (10-14)	- 35.513	- 50.138	+ 6.600	7.876	131.483	126.426	134.643	137.843	136.026	144.243	147.443	175.626	269.276
Accrued													
Capital	40.000	70.000											
Cash Balance	+ 4.487	+ 19.862	6.600	7.876	131.483	126.426	134.643	137.843	136.026	144.243	147.443	175.626	269.276
Accrued		24.349	30.949	38.825	170.308	296.734	431.377	569.220	705.246	849.489	996.932	1.172.558	-

Nota : This statement shows the relation existing between the cashflow of chart 10-13, the one of chart 10-14 and the cash balance of chart 10-8/3.

NIGER SAVINGS IN FOREIGN EXCHANGE EXHIBIT 10-16 ER

000 of F CFA	1 1983	2 1984	3 1985	4 1986	5 1987	6 1988	7 1989	8 1990	9 1991	10 1992	11 1993	12 1994	13 1995			
a) Gross savings in foreign exchange (10-14)			420.650	841.301	841.301	841.301	841.301	841.301	841.301	841.301	841.301	841.301		à 10	à 12	à
b) Use of foreign exchange																
. Investment (10-6/2) (a)	28.317	179.699	50.479	50.480									(100.950)			
. Operation (10-12)	-	-	142.533	285.067	285.067	285.067	285.067	285.067	285.067	285.067	285.067	285.067				
c) Foreign Exchange Credit (10-14)																
. Loans		190.000	60.000													
. Reimbursements				30.000	30.000	30.000	30.000	30.000	30.000	30.000	30.000	10.000				
. Interests				40.000	35.200	30.400	25.600	20.800	16.000	11.200	6.400	1.600				
. Expenses				150												
d) Net savings in foreign exchange :	(28.317)	10.301	287.638	435.604	491.034	495.834	500.634	505.434	510.234	515.034	519.834	524.634	100.950	2.604.177	2.331.823	1.99
Use for national resources (b)																
. Investment (10-6/2)(a)	7.196	140.439	59.638	47.147	(3.240)								(103.545)			
. Exploitation (10 - 12)	-	-	197.451	244.994	206.114	206.114	206.114	206.114	206.114	206.114	206.114	206.114				
TOTAL	7.196	140.439	257.089	292.141	202.874	206.114	206.114	206.114	206.114	206.114	206.114	206.114	(103.545)	1.357770	1.245633	1.1

Notes : a) Initial investment, recovery of working capital at end of project.
- parentheses indicate elements of sign different from the others on same line.
b) On account of unavailability of data expenses contents of imports could not be deducted from expenses in local currency.
- The local currency considered is the F CFA of January 1983.

CHAPTER X

EXHIBITS - STUDY FOR PLANT IN NIGERIA

NIGERIA

EXHIBITS 10-1/1 et 10-1/2 :

COSTS OF INITIAL PERMANENT INVESTMENTS
(IN NAIRA) (see text pages 102-103)

Item	Investment category	Chapter source	Foreign Exchange	Local Currency	Total cost
1.	Land	5.1	For the record		
2.	Site preparation and lay-out	6.7		12 500	12 500
3.	Structures and civil engineering work				
	a) Buildings and civil engineering works	6.7	70 800	165 200	236 000
	b) Auxiliary installations and services	6.7		20 160	20 160
4.	Incorporeal investments	6.1	See Nota		
5.	Vehicles			24 080	24 080
6.	Machines and equipment installation	6.3	203 256	44 498	247 754
7.	Total cost of initial permanent investments		274 056	266 438	540 494

NOTA : . Item 4 - the use of licences is included in the operating expenses (royalties proportional to sales).

. Chart 10-1/2 is associated to chart 10-1/1 since all the investment takes place within the same year (1984).

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EXHIBIT 10-2/1 : FIRST ESTABLISHMENT EXPENDITURES, PRIOR TO PRODUCTION

(see text pages 103 - 104)

(in Naira)

Poste Item	Category	Source	Foreign Exchange	Local Currency	Total
1.	Preinvestment studies	Exh. 2.1	27 504		27 504
2.	Preliminary research	2.1	4 095	1 819	5 914
3.	Direction of project's implementation	9.1	43 066	9 923	52 989
4.	Detailed planning, invitations to tender	9.1			
5.	Control, coordination testing and reception of civil engineering works, equipment and installations	9.1	(see Nota)		
6.	Set-up of the management recruitment and training of supervisory and operating personnel	9.1	20 167	60 880	81 047
7.	Organization of supply	9.1		8 413	8 413
8.	Organization of marketing	9.1			
9.	Set-up of connections, legal expenses	9.1		5 404	5 404
10.	Varied and unexpected expenses	9.1		9 064	9 064
	T O T A L		94 832	95 503	190 335

NOTA : Item 5 - included in installations

NIGERIA

EXHIBIT 10-2/2 : FIRST ESTABLISHMENT EXPENDITURES, PRIOR TO PRODUCTION PER ANNUM

(See text page 104)

Period	PREPARATION			CONSTRUCTION			TOTAL		
Year	1983			1984					
Financing (in ₦)	D	L	T	D	L	T	D	L	T
First establishment expenditures	56895	14630	71525	37937	80873	118810	94832	95503	190335

NOTA : D = Foreign currency ; L = local currency ; T = total

NIGERIA

EXHIBITS 10-3/1 10-3/2 :

CALCULATION OF WORKING CAPITAL REQUIREMENT

(see text page 104)

ITEM	Minimum period to cover	Ratio to turnover	Necessary funds (in Naira)		
			Starting years	Years of running at cruising speed	
			1985	1986	1987 and >
1. Circulating assets (Current assets)					
A. Accounts receivable	1 month	12	70 108	140 217	140 217
B. Stocks					
a) Rawstuff	4 months	3	99 515	199 031	199 031
b) Spare parts	(see NOTA)				
c) Production in progress	2 days	115	2 828	5 657	5 657
d) Finished products	1/2 month	24	35 054	70 108	70 108
C. Cash in hand	1 month	12	27 971	27 971	21 491
D. Circulating assets (A + B + C)			235 476	442 984	436 504
2. Running liabilities					
. Accounts payable	1/2 month	24	13 554	27 107	27 107
3. Working capital					
. Net working capital			221 922	415 877	409 397
. Increase of working capital			221 922	193 955	- 6 480

NOTA : Item a - The rawstuffs are supposed to be all imported in a first period . Later on, they will be replaced by local products.

Item b - The spare parts are included in the initial investment.

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EXHIBIT 10-6/1 : SUM OF INITIAL INVESTMENT EXPENDITURES

(see text pages 105-106)

Item : Category of investment	Foreign Exchange (in ₦)	Local Currency (in ₦)	TOTAL (in Naira)
1. Cost of initial permanent investments (source exh. 10-1/1)	274 056	266 438	540 494
2. First establishment expenditures (Source : exhibit 10-2/1)	94 832	95 503	190 335
3. Fonds de roulement (année de croisière (source : exh. 01-3/2 3rd year)	201 918	207 479	409 397
	570 806	569 420	1 140 226

NOTA : Working capital foreign exchange = imported rawstuffs

N I G E R I A

Exhibit 10-6/2 TOTAL OF INVESTMENT COSTS (IN NAIRA)

(see text page 106)

PERIOD	PREPARATION			CONSTRUCTION			START-UP			WORK AT CRUISING SPEED						TOTAL		
YEAR	1983			1984			1985			1986			1987					
FINANCING (in Naira)	D	L	T	D	L	T	D	L	T	D	L	T	D	L	T	D	L	T
1. Cost of initial permanent investment				274056	266438	540494										274056	266438	540494
2. First establishment expenses (source exhibit 10-2/2)	56895	14630	71525	37937	80873	118810										94832	95503	190335
3. Increase of working capital (source : exh. 10-3/2 § 3)							99515	122407	221922	99515	94440	193955	0	-6480	-6480	199030	210367	409397
Total cost of investment	56895	14630	71525	311993	347311	659304	99515	122407	221922	99515	94440	193955	0	-6480	-6480	567918	572308	1140226

NOTA : Reinvestment in 1988/1991 and 1994 do not figure in this chart which bears only on the first 5 years. These reinvestments figure on combined chart 10-13/10-14

EXHIBIT 10-7/1 : TOTAL OF INITIAL ASSETS
(see text page 106)

Item : category of investment	Foreign Exchange	Local Currency	TOTAL in ₦
1. Cost of initial permanent investments (source : exh. 10-1/1)	274 056	266 438	540 494
2. First establishment expenditures (source : exhibit 10-2/1)	94 832	95 503	190 335
3. Circulating assets (at full capacity) (source exhibit 10-3/2 3rd year § 1 D)	199 031	237 473	436 504
TOTAL	567 919	599 414	1 167 333

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EXHIBIT 10-7/2 : TOTAL OF ASSETS (see text pages 106-107)

PERIOD	PREPARATION			CONSTRUCTION			START-UP			WORK AT CRUISING SPEED						TOTAL		
YEAR	1983			1984			1985			1986			1987					
FINANCING (in Naira)	D	L	T	D	L	T	D	L	T	D	L	T	D	L	T	D	L	T
1. Cost of initial permanent investments				274056	266438	540494										274056	266438	540494
2. First establishment expenses (source exhibit 10-2/2)	56895	14630	71525	37937	80873	118810										94832	95503	190335
3. Increase of circulating assets (source : exhibit 10-3/2)							99515	135961	235476	99516	107992	207508	0	- 6480	-6480	199031	237473	436504
TOTAL OF ASSETS	56895	14630	71525	311993	347311	659304	99515	135961	235476	99516	107992	207508	0	- 6480	-6480	567919	599414	1167333

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PIECE 10-8/1 - SOURCES OF FINANCING

(see text page 108)

Sources of financing	Local currency	Foreign Exchange	TOTAL (in N)
1. Developers			
- ordinary shares	120.000		120.000
2. Associates			
- Ordinary shares	50.000	50.000	100.000
3. Financial institutions or development organizations :			
- Loans	160.000	500.000	660.000
4. State			
5. Commercial banks			
6. Public bonds			
7. Credit by suppliers			
8. Running liabilities (rounded off)		27.000	27.000
TOTAL all items	330.000	577.000	907.000

N I G E R I A

EXHIBIT 10-8/2 SOURCE OF INITIAL FINANCING

(see text page 108)

Period	Preparation			Construction			Start-up			Work at cruising speed			TOTAL (in ₦)		
Year	1983			1984			1985			1986					
Financing (in ₦)	D	L	T	D	L	T	D	L	T	D	L	T	D	L	T
Ordinary shares		80.000	80000	50000	90000	140000							50000	170000	220000
Loans				380000	160000	540000	120000		120000				500000	160000	660000
Running liabilities (rounded off)							13500		13500	13500		13500	27000		27000
TOTAUX	0	80000	80000	430000	250000	680000	133500		133500	13500		13500	577000	330000	907000

Note D = Foreign exchange L = Local currency T = total.

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EXHIBIT 10-8/3 : CHART OF CASHFLOW FOR FINANCIAL PLANNING

(See text pages 108-109)

Period	Preparation	Execution	Starting up	PLANT IN OPERATION AT CRUISING SPEED									Liquidation year
Year	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Production programme (source : exh. 3-3)	0	0	50	100	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	
Costs (n N)													
A. Cash incomes	80 000	680 000	974.801	1.696.102	1.682.602	1.682602	1682602	1682602	1682602	1682602	1682602	1682602	(27.107)
1. Total of financial resources (source : exh. 10-8/2)	80.000	680.000	133.500	13.500									
2. Product of sales (source : exh. 3-1)			841 301	1 682 602	1682 602	1682602	1682602	1682602	1682602	1682602	1682602	1682602	
B. Cash expenditures	71.525	659.304	976.872	1.649.801	1.382.925	1.409.965	1.382.365	1.378.845	1.399.405	1.371.805	1.358.285	1.328.845	
1. Constitution of total assets, including replacement. (source : exhibit 10-7/2)	71 525	659 304	235 476	207 508	-6 480	24 080			24 080			24 080	(578.860)
2. Operating expenses (source : exhib. 10-12)			711 416	1087182	1009422	1009422	1009422	1009422	1009422	1009422	1009422	1009422	
3. Loans reimbursements : (total)													
a) Interests :													
Bank loans				64 800	46 400	40 000	33 600	27 200	20 800	14 400	8 000	1 600	
b) Reimbursements :													
Bank loans				80 000	80 000	80 000	80 000	80 000	80 000	80 000	80 000	20 000	
4. Corporate taxes (source : exhib. 10-9)			29 980	210 311	253 583	256 463	259 343	262 223	265 103	267 983	270 863	273 743	
C. Surplus or deficit	8 475	20 696	-2017	46 354	299 677	272 637	300 237	303 757	283 197	310 797	314 317	353 757	549 747
D. Accrued cashflow	8.475	29.171	27.154	73.508	373.185	645.822	946.059	1.249.816	1.533.013	1.843.810	2.158.127	2511.884	3061.631

NOTA : Item A-1 : includes accounts payable of the working capital Item B-5 : there is no statuary dividend at this stage of the study
Item B 1 : year 1995 : half of the redeemable in 20 years assets plus 1/3 of repayment of 1994 plus recuperation of net assets of the working capital requirements.

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EXHIBIT 10-9 : SCHEDULE OF NET INCOME (see text page 110)

Period	Preparation	Construction	Sarting-up	Cruising speed	
Year	1983	1984	1985	1986	1987
Production programme			50 %	100 %	100 %
Costs (in N)					
1. Sales			841.301	1.682.602	1.682.602
2. Production costs			774.677	1.215.244	1.119.084
3. Gross or taxable income (1-2)			66.624	467.358	563.518
4. Taxes			29.980	210.311	253.583
5. Net income (3 - 4)			36.644	257.047	309.935
6. Retained profit			36.644	257.047	309.935
7. Accrued retained profits			36.644	293.691	603.626
8. Ratios					
Gross income : sales (%)				27,7	33,4
Net income : sales (%)				15,2	18,4
Net income : equity (%)				116,8	140,8

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EXHIBIT 10-10 PROJECTED BALANCE SHEET (see text page 109)

Period	Preparation	Construction	Starting up	Cruising Speed								
Year	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	19[illegible]
A. Assets (total)	80.000	760.000	930.144	1.120.691	1.350.626	1.566.587	1.1803.562	2.044.057	2.263.992	2.511.527	2.762.582	3.053.[illegible]
1. Running assets (accrued total)												
a) Cash balance (source exh. 10-8/3)	8.475	29.171	24.154	73.508	373.185	645.822	946.059	1.249.816	1.533.013	1.843.810	2.158.127	2.51[illegible]
b) Circulating assets (Source exhibit 10-3/2)			235.476	442.984	442.984	442.984	442.984	442.984	442.984	442.984	442.984	442.9[illegible]
2. Permanent assets (after depreciation) Initial permanent investments, replacements and first establ. expen.	71.525	730.829	667.567	604.305	541.043	477.781	414.519	351.257	287.995	224 733	161.471	9[illegible]
B. Liabilities (total)	80.000	760.000	930.144	1.120.691	1.350.626	1.566.587	1.803.562	2.044.057	2.263.992	2.511.527	2.762.582	3.053.[illegible]
1. Running liabilities			13.500	27.000	27.000	27.000	27.000	27.000	27.000	27.000	27.000	27.00
2. Short term and medium term loans		540.000	660.000	580.000	500.000	420.000	340.000	260.000	180.000	100.000	20.000	0
3. Capital	80.000	220.000	220.000	220.000	220.000	220.000	220.000	220.000	220.000	220.000	220.000	220.00
4. Reserves (source exhibit 10-9 line 7)	-	-	36.644	293.691	603.626	899.587	1.216.562	1.537.057	1.836.992	2.164.527	2.495.582	2.806.07[illegible]

N I G E R I A

EXHIBIT 10-11 TOTAL COST OF PRODUCTION IN A YEAR
AT CRUISING SPEED (YEAR 1987)

(see text pages 110 - 111)

(in ₦)

I T E M	Foreign Exchange	Local Currency	TOTAL
1. Material and direct production factors (source : exh. 4-2)	477.590	172.985	650.575
2. Direct manpower operating and supervisory personnel (source : exhibit 8-2 & 8-4)		246.429	246.429
3. Overhead		11.462	11.462
4. Marketing expenses	75.717	25.239	100.956
Operating costs (1+2+3+4+5)	553.307	456.115	1.009.422
5. Financial overhead (source : chap X)	35.152	11.248	46.400
6. Depreciation		63.262	63.262
TOTAL of cost of production	588.459	530.625	1.119.084

N I G E R I A

EXHIBIT 10-12 SPREADING OF COSTS OF PRODUCTION

(see text pages 110 - 111)

Period	Starting-up			Working at cruising speed					
Year	1985			1986			1987		
Production programme	50 %			100 %			100 %		
Financing (in N)	D	L	T	D	L	T	D	L	T
1. Direct material	238795	86491	325286	477590	172985	650575	477590	172985	650575
2. Direct manpower		324189	324189		324189	324189		246429	246429
3. Plant and administration overhead		11462	11462		11462	11462		11462	11462
Production expenses (1 + 2 + 3 + 4)	238795	422142	660937	477590	508636	986226	477590	430876	908466
4. Sales and marketing expenses :	37858	12620	50478	75717	25239	100956	75717	25239	100956
Operating expenses (1+2+3+4)	276653	434762	711415	553307	533875	1087182	553307	456115	1009422
5. Financial costs	0	0	0	49087	15713	64800	35152	11248	46400
6. Depreciation		63262	63262		63262	63262		63262	63262
Total of costs of production (1+2+3+4+5+6)	276653	498024	774677	602394	612850	1215244	588459	530625	1119084

NOTE D = Foreign exchange L = Local currency T = total.

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EXHIBIT 10-13 - CHART OF CASHFLOW AND CALCULATION OF ACTUALIZED VALUE IN THE CASE OF A PROJECT GEETING NO EXTERIOR FINANCING

(See text pages : 113 - 114)

Period	Execution		Starting-up			Working at cruising speed							
Year	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Production programme (source : exhib.3-3)	0	0	50 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
Value (in N)													
A. Cash incomes													
1. Total of sales (source exhib.3-1)			841 301	1682602	1682602	1682602	1682602	1682602	1682602	1682602	1682602	1682602	
B. Cash expenditures (1+2+3)	71.525	659.304	963.318	1520.608	1277.405	1307.965	1283.885	1283.885	1307.965	1289.885	1283.885	1307.965	(549.747)
1. Total investment expenses (source exhib.10-6/2	71 525	659 304	221 922	193 955	(6480)	24 080			24 080			24 080	
2.Operating expenses (source exh. 10- 12)			711 416	1087182	1009422	1009422	1009422	1009422	1009422	1009422	1009422	1009422	
3. Corporate taxes (source exhib.10-3/1)			29 980	239 471	274 463	274 463	274 463	274 463	274 463	274 463	274 463	274 463	
C. Net cashflow (A-B)	-71 525	-659 304	-122 017	161 994	405 197	374 637	398 717	398 717	398 717	398 717	398 717	374 637	(549 747)
D. Actualized value													
E. Net accrued cashflow	-71 525	-730 829	-852 846	-690 852	-285 655	88 982	487 699	886 416	1261053	1659770	2058487	2433124	2982871

NOTA : Item D the internal yield ratio calculated by machine is of about 28,74 %

· - Liquidation value : See ventilation exhibit 10-13 NIGER

EXHIBIT 10-14 : CHART OF CASHFLOW AND CALCULATION OF ACTUALIZED VALUE
IN THE CASE OF A PROJECT GETTING SOME EXTERIOR FINANCING

(See text page 114)

Period	Prepara-tion	Construc-tion	Starting up	Working at cruising speed									Liquidation value
Year	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Production programme (source : exhib. 3/3)	0	0	50 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	
Value (in ₦)													
A. Cash incomes													
1. Total of sales (source : exh. 3/1)			841 301	1682602	1682602	1682602	1682602	1682602	1682602	1682602	1682602	1682602	
B. Cash expenditures													
1. Total investment expenses (permanent investm.)	71.525	119.304	101.922	338.755	119.920	144.080	113.600	107.200	124.880	94.400	88.000	45.680	(549.747)
a) Capital	71 525	119 304	101 922	193 955	(-6480)								
b) Replacement of vehicles (source Exhib. IU-8/2)						24 030			24 080			24 080	
c) Loan reimbursent.				80 000	80 000	80 000	80 000	80 000	80 000	80 000	80 000	20 000	
d) Loan interests				64 800	46 400	40 000	33 600	27 200	20 800	14 400	8 000	1 600	
2. Operating expenses (source : exhibit 10- 12)			711 416	1087182	1009422	1009422	1009422	1009422	1009422	1009422	1009422	1009422	
3. Corporate taxes (source : exhib.10-9)			29 980	210 311	253 583	256 463	259 343	262 223	265 103	267 983	270 863	273 743	
C. Net cashflow (A-B)	- 71 525	-119 304	- 2 017	46 354	299 677	272 637	300 237	303 757	283 197	310 797	314 317	353 757	(549 747)
D. Actualized value (a)													

NOTE : Item D : the calculation of actualization has been calculated on machine and has given 56,12 %

Plant in NIGERIA in N	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Product of sales			841.301	1.682.602	1.682.602	1.682.602	1.682.602	1.682.602	1.682.602	1.682.602	1.682.602	1.682.602	-
Total administrat. expenses													
Permanent investments		540.494				24.080			24.080			24.080	140.350
First establishment expenses	71.525	118.810											
Working capital			221.922	193.955	- 6.480								409.397
Operating expenses			711.416	1.087.182	1.009.422	1.009.422	1.009.422	1.009.422	1.009.422	1.009.422	1.009.422	1.009.422	-
Corporate taxes			29.980	239.471	274.463	274.463	274.463	274.463	274.463	274.463	274.463	274.463	-
Cashflow (10-13)	- 71.525	- 659.304	- 122.017	161.994	405.197	374.637	398.717	398.717	374.639	398.717	398.717	374.637	549.747
Accrued	- 71.525	- 730.829	- 852.846	- 690.852	- 285.655	+ 88.982	487.699	886.416	1.261.053	1.659.770	2.058.487	2.433.124	
Loan		540.000	120.000										
Reimbursement				80.000	80.000	80.000	80.000	80.000	80.000	80.000	80.000	20.000	
Interest(8 %)				64.800	46.400	40.000	33.600	27.200	20.800	14.400	8.000	1.600	
Taxes correction				29.160	20.880	18 000	15.120	12.240	9.360	6.480	3.600	720	
Cashflow (10-14)	- 71.525	- 119.304	- 2.017	+ 46.354	299.677	272.637	300.237	303.757	283.197	310.797	314.317	353.757	549.747
Accrued													
Capital	80.000	140.000											
Cash balance	+ 8.475	+ 20.696	- 2.017	46.354	299.677	272.637	300.237	303.757	283.197	310.797	314.317	353.757	549.747
Accrued		29.171	27.154	73.508	373.185	645.822	946.059	1.249.816	1.533.013	1.843.810	2.158.127	2.511.884	

Nota : This statement shows the relation existing between the cashflow of chart 10-13, the one of chart 10-14 and the cash balance of chart 10-8/3.

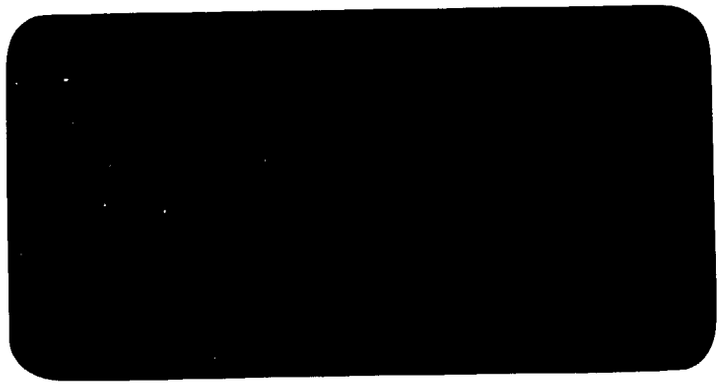
N I G E R I A

SAVINGS IN FOREIGN EXCHANGE EXHIBIT 10-16 IA

n Nairas	1 1983	2 1984	3 1985	4 1986	5 1987	6 1988	7 1989	8 1990	9 1991	10 1992	11 1993	12 1994	13 1995	Valeur actualisée à 10	à 12	à
a) Gross savings in foreign exchange (10-14)	-	-	841.301	1682.602	1682.602	1682.602	1682.602	1682.602	1682.602	1682.602	1682.602	1682.602				
b) Use of foreign exchange																
. Investment (10-6/2) (a)	56.895	311.993	99.515	99.515									(201.918)			
. Exploitation (10-12)			276.653	553.307	553.307	553.307	553.307	553.307	553.307	553.307	553.307	553.307				
c) Foreign Exchange Credit (10-14)																
· Loans		380.000	120.000													
· Reimbursements				60.000	60.000	60.000	60.000	60.000	60.000	60.000	60.000	20.000				
· Interests				40.000	35.200	30.400	25.600	20.800	16.000	11.200	6.400	1.600				
· Expenses				300												
d) Net savings in foreign exchange :	(56.895)	68.007	585.133	929.480	1034.095	1038.895	1043.695	1048.495	1053.295	1058.095	1062.895	1067.695	201.918	5453.853	4889.568	4184.
Use for national resources (b) :																
· Investment (10-6/2)(a)	14.630	347.311	122.407	94.440	(6.480)								(207.479)			
. Exploitation (10 - 12)			434.762	533.875	456.115	456.115	456.115	456.115	456.115	456.115	456.115	456.115				
TOTAL	14.630	347.311	556.809	628.315	449.635	456.115	456.115	456.115	456.115	456.115	456.115	456.115	207.479			

Notes : a) Initial investment, recovery of working capital at end of project.
- parantheses indicate elements of sign different from the others on same line.
b) On account of unavailability of data expenses contents of imports could not be deducted from expenses in local currency.
- The local currency considered is the Naira of January 1983.

13160
(2 of 2)



SOFRECO

SOCIÉTÉ FRANÇAISE DE RÉALISATION, D'ÉTUDES ET DE CONSEIL

9, RUE ALFRED DE VIGNY 75008 PARIS-FRANCE - Tél. 622.19.11 (4 lignes groupées) Tx 642610 F

SOFRECO

13160
(2 of 2)

UNIDO PROJECT N° DP/RAF/77/020

CODE DP/RAF/31.6

APPENDIX TO THE PREFEASIBILITY STUDY

ON MILLET AND SORGHUM

MILL PRODUCTION UNIT

VOLUME 2

February 1983

A P P E N D I X

Map of NIGER - Visited departments

Map of NIGERIA - Visited states

Plan N° 1 - Level view of the mill production plant.

Plan N° 2 - Plant officer - section view

Plan N° 3 - CFDT Maradi (NIGER) plant

PLan N° 4 - Maradi industrial area

Figure N° 1 ER - NIGER population

Figure N° 2 ER - Millet and sorghum surfaces and production (NIGER)

Figure N° 3 ER - Millet and sorghum production suitable for consumption in NIGER

Figure N° 4 ER - Millet and sorghum consumption in NIGER

Figure N° 5 ER - Mill import licences in NIGER

Figure N° 1 IA - NIGERIA population

Figure N° 2 IA - Millet and sorghum production in NIGERIA

Figure N° 3 IA - Millet and sorghum consumption in NIGERIA

Figure N° 4 IA - Number of mills estimate

Figure N° 5 IA - Mills imports in NIGERIA

Figure N° 6 IA - Mills manufacturers

Descriptive brochures for some plate mills

Descriptive brochures for PRL/IDRC Dehuller

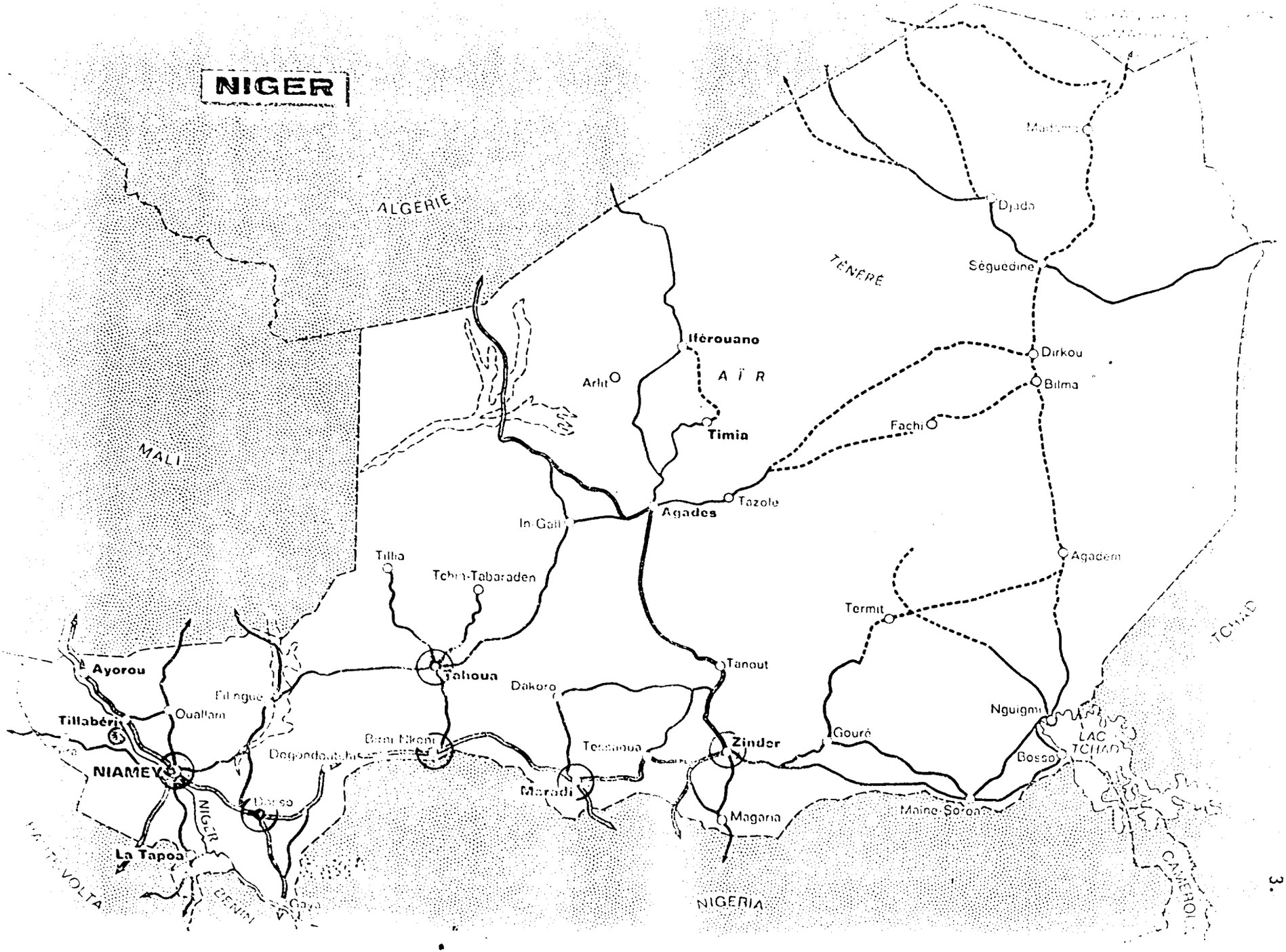
Plans of PRL/IDRC Dehuller (plans 321, from 1 to 7)

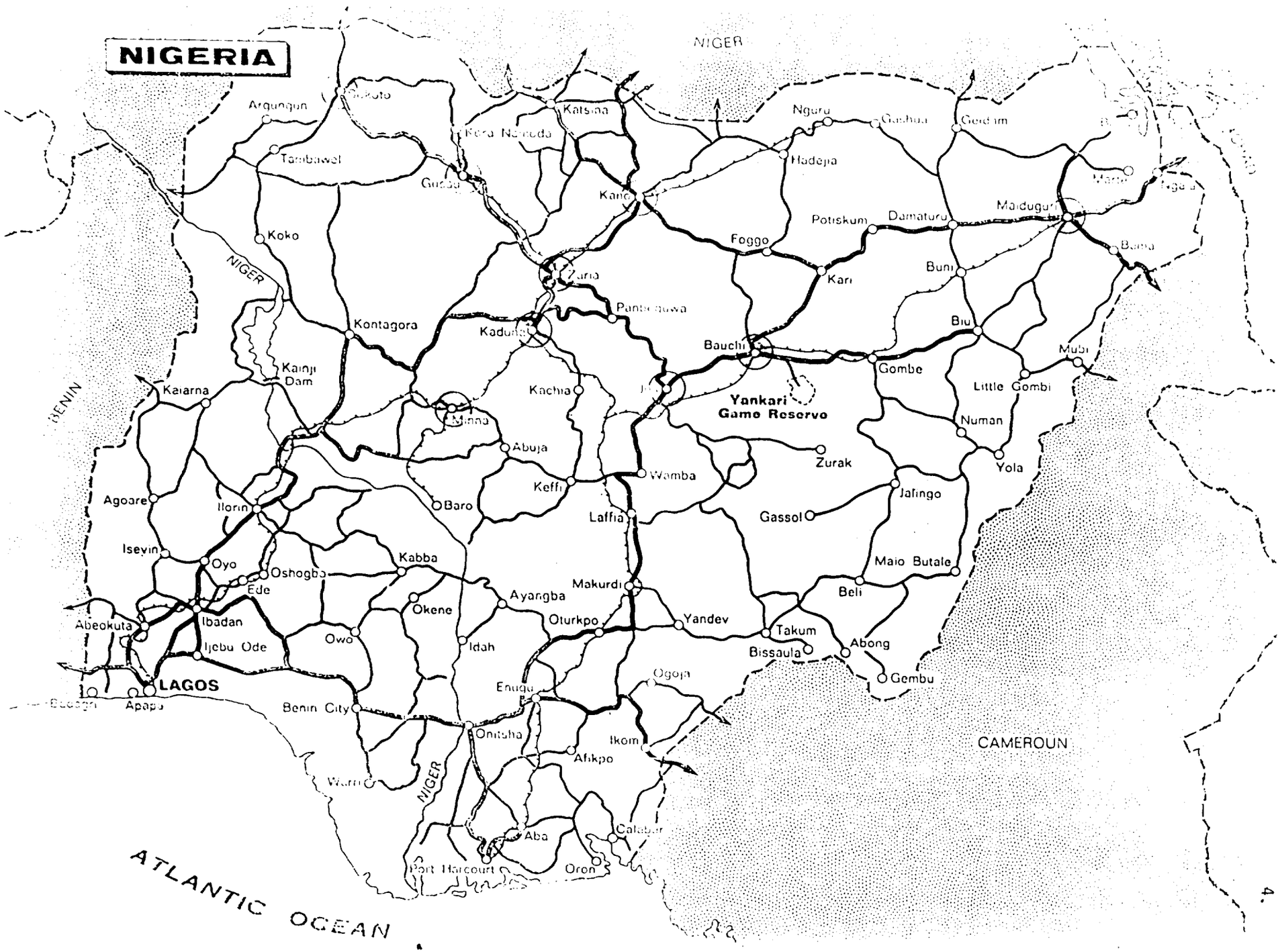
Lewis Grant Ltd's letter concerning the types fo dehullers used in NIGER AN NIGERIA

Note concerning mills and dehullers drive engines

Terms of references

MAPS NIGERIA/NIGER


NIGER
ALGERIE
MALI
NIGERIA
TCHAD
CAMEROUN
BENIN
HAUTE-VOLTA
TENERE
A Ï R
Madama
Djado
Séguedine
Dirkou
Bilma
Fachi
Iférouane
Arlit
Timia
Agadès
Tazolé
In-Gall
Tchin-Tabaraden
Tilia
Agadem
Termit
Tanout
Tahoua
Dakoro
Ayorou
Filingué
Tillabéri
Ouallam
Birni Nkoni
Dogondoutchi
NIAMEY
Dosso
Gaya
La Tapoa
Tessaoua
Zinder
Goure
Nguigmi
LAC TCHAD
Bosso
Maradi
Magaria
Maine-Soroa


NIGERIA
NIGER
Argungun
Tambawel
Koko
Gusau
Katsina
Nguru
Gashua
Geidam
Hadejia
Kano
Potiskum
Damaturu
Maiduguri
Foggo
Kari
Buni
Biu
Mubi
Gombe
Little Gombi
Numan
Yola
Jalingo
Gassol
Zurak
Yankari
Game Reserve
Bauchi
Kontagora
Kaduna
Kainji
Dam
Kaiama
Kachia
Minna
Abuja
Wamba
Keffi
Laffia
Baro
Ilorin
Agoare
Isevin
Oyo
Oshogbo
Ede
Kabba
Okene
Ayangba
Makurdi
Oturkpo
Yandev
Idah
Owo
Ibadan
Abeokuta
Ijebu Ode
LAGOS
Apapa
Benin City
Onitsha
Enugu
Ogoja
Afikpo
Ikom
Takum
Bissaula
Abong
Gembu
Beli
Maio Butale
Aba
Port Harcourt
Oron
Calabar
CAMEROUN
BENIN
ATLANTIC OCEAN

MILL PRODUCTION PLANT

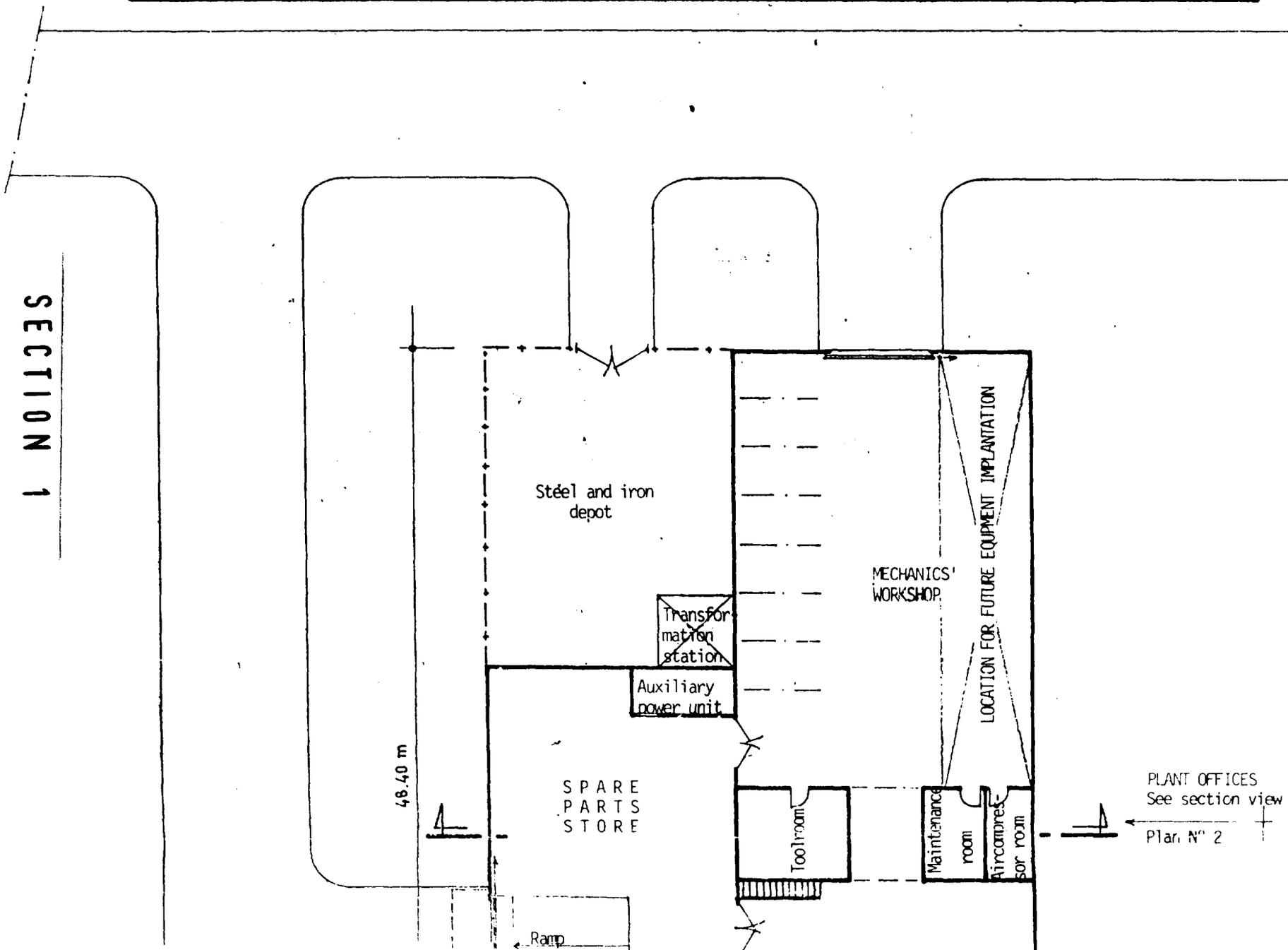
Plan N° 1 - Level view of the mill production plant

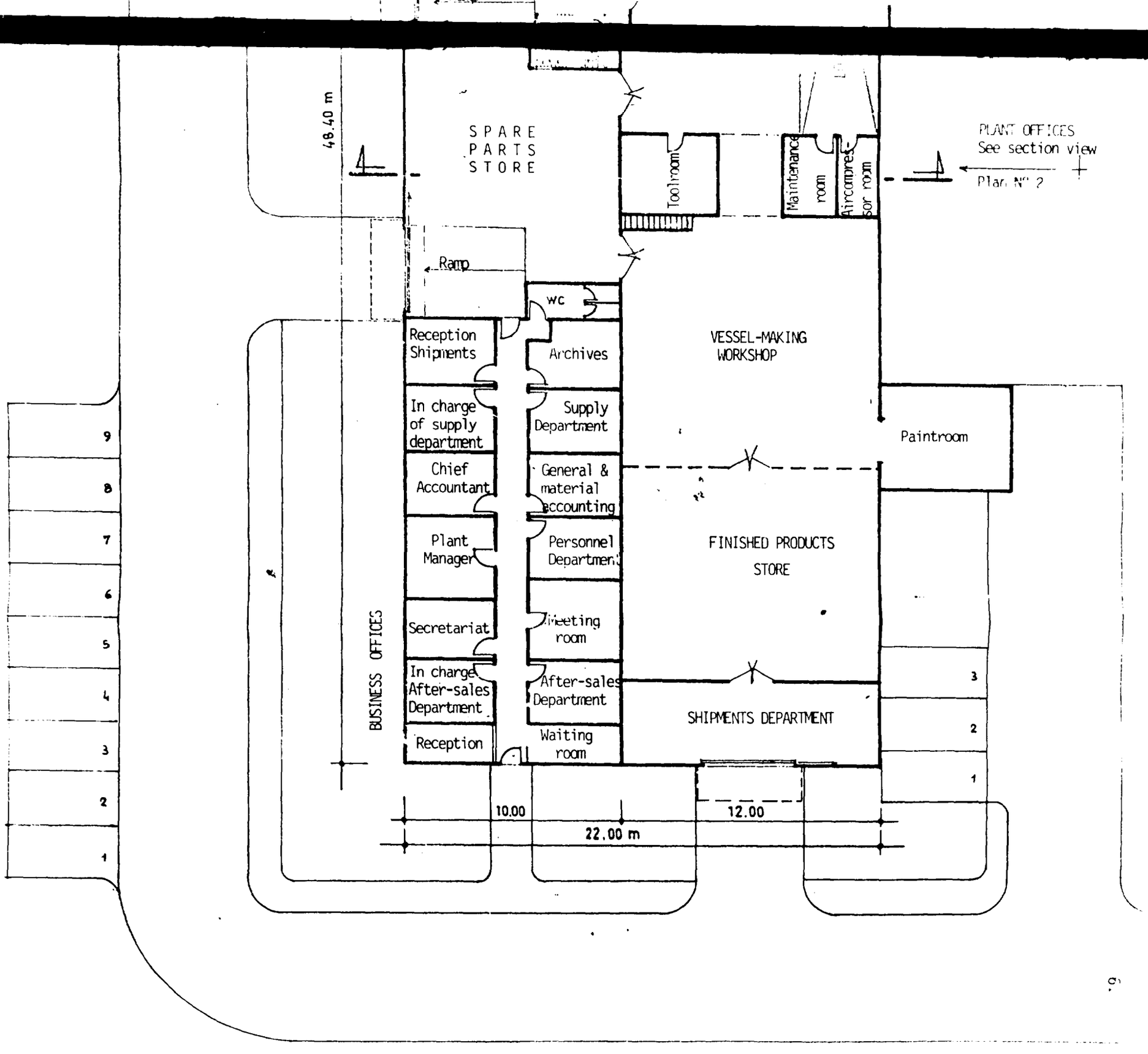
Plan N° 2 - Plant offices - section view

Plan N° 3 - CFDT plant, in MARADI (NIGER)

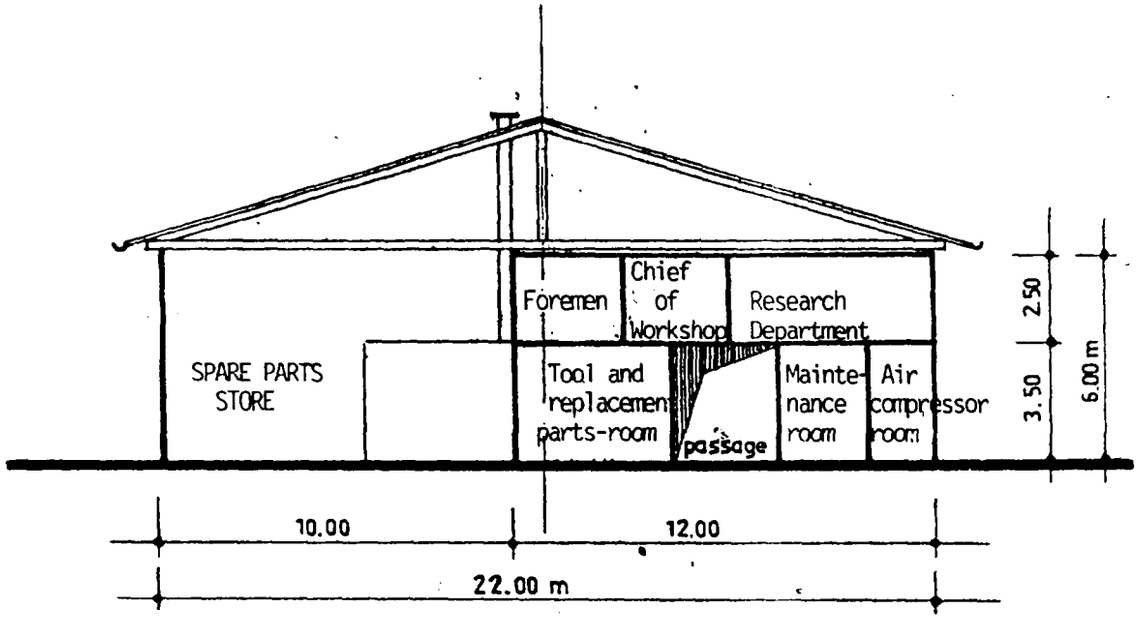
Plan N° 4 - Industrial development zone of MARADI

SOFRECO	PLAN OF MILL CONSTRUCTION PLANT	PLAN n° 1
9, RUE ALFRED DE VIGNY - 75008 PARIS		Scale 1/200 DATE 9.2.1983



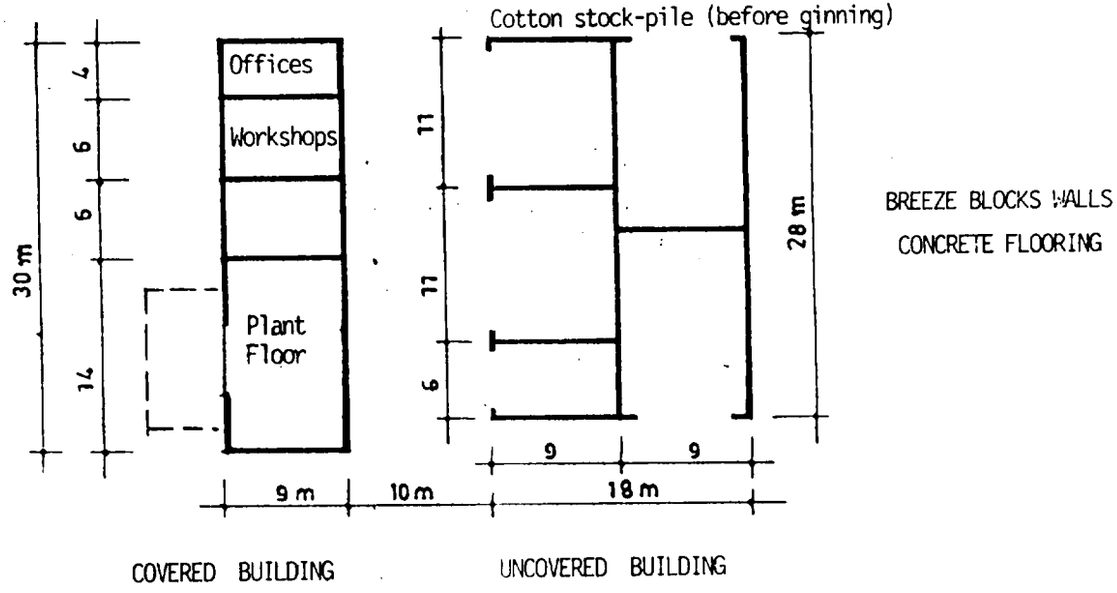

SECTION 2
48.40 m
SPARE PARTS STORE
Toolroom
Maintenance room
Aircompressor room
PLANT OFFICES
See section view
Plan N° 2
Ramp
WC
Reception Shipments
Archives
VESSEL-MAKING WORKSHOP
In charge of supply department
Supply Department
Paintroom
Chief Accountant
General & material accounting
Plant Manager
Personnel Department
FINISHED PRODUCTS STORE
Secretariat
Meeting room
BUSINESS OFFICES
In charge After-sales Department
After-sales Department
SHIPMENTS DEPARTMENT
Reception
Waiting room
10.00
12.00
22.00 m
9
8
7
6
5
4
3
2
1
3
2
1

SOFRECO 9 RUE ALFRED DE VIGNY - 75008 PARIS	SECTION VIEW - PLANT OFFICES	PLAN n° 2 Scale 1/200 DATE: 9.2.1983



FOR OFFICES LOCATION SEE PLAN N° 1

SOFRECO 9, RUE ALFRED DE VIGNY - 75008 PARIS	PLAN CFDT PLANT IN MARADI (See industrial Development Zone)	PLAN N°3 Scale 1/500 DATE 9 2 1983

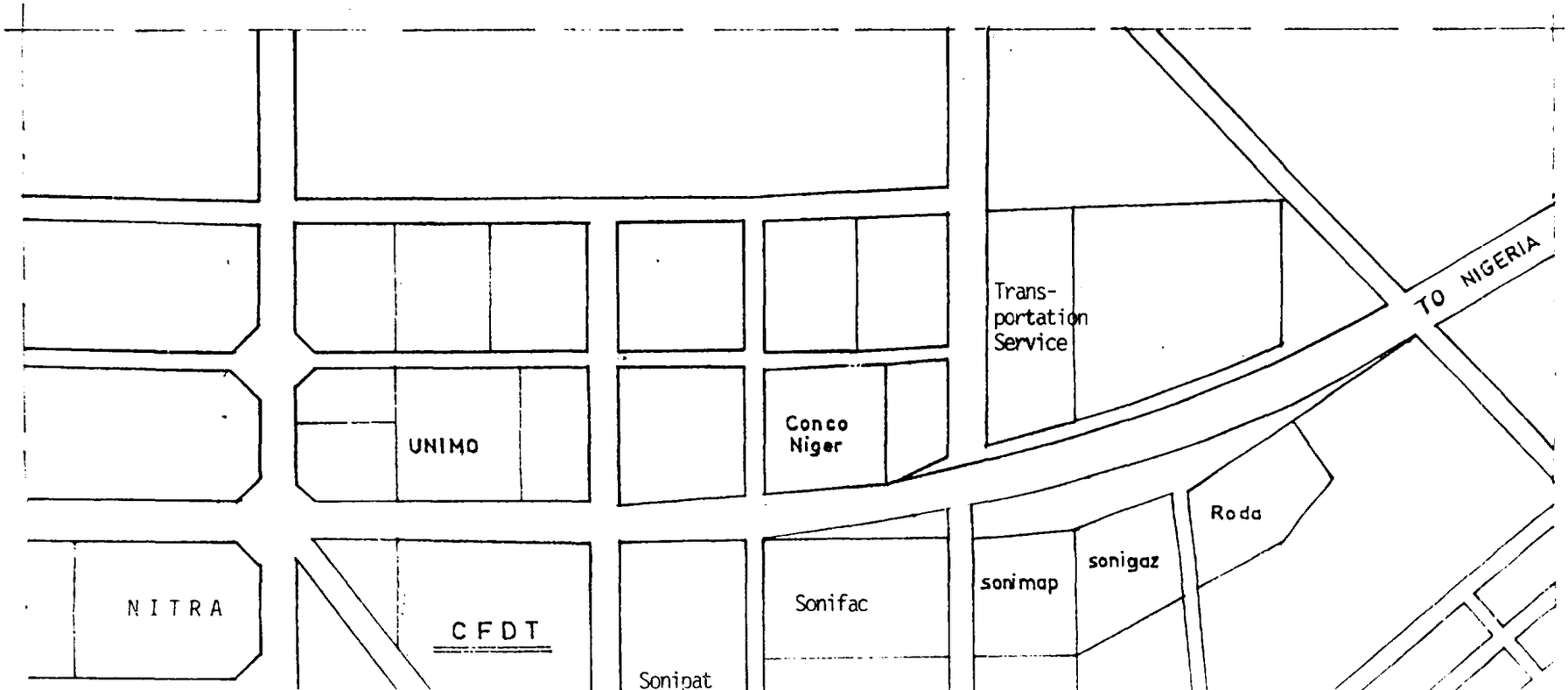


BREEZE BLOCKS WALLS
CONCRETE FLOORING

Nota : Figures are approximate

SECTION 1

SOFRECO 9, RUE ALFRED DE VIGNY - 75008 PARIS	INDUSTRIAL DEVELOPMENT ZONE TOWN OF MARADI	PLAN n° 4 Scale 1/5000 DATE 9.2.1983



UNIMO
Conco Niger
Roda
NITRA
CFDT
Sonipat
Sonifac
sonimap
sonigaz
LAKO Highschool
CEG II
State Highschool
GARAGE

SECTION 2

C H A R T S

. POPULATIONS

. MILLET AND SORGHUM PRODUCTIONS AND CONSUMPTIONS

. MILL IMPORTS

CHARTS NIGER STUDY

NIGER

CHART N° 1. EP

NIGER POPULATION - SOURCE : 5 YEAR PLAN (1979/1983)
AND 1977 CENSUS

	Population 1977 Census	Average Growth rate	78	79	80	81	82	83	84	85	86	87	88	89	90	91	9
. Total population	5 098,4	2,77	5 240	5 385	5 534	5 688	5 845	6 007	6 173	6 344	6 520	6 701	6 886	7 077	7 273	7 475	7 6
. Urban population	601,9		646	692	740	791	843	897	952	1 010	1 071	1 134	1 199	1 267	1 338	1 412	1 4
. Sedentary country population	3 762,1	2,3	3 849	3 938	4 028	4 121	4 215	4 312	4 412	4 513	4 617	4 723	4 832	4 943	5 056	5 172	5 29
. Nomadic population	734,4	1,4	745	755	766	776	787	798	809	821	832	844	855	867	879	891	9
TOTAL COUNTRY POPULATION (3 + 4)			4 594	4 693	4 794	4 897	5 002	5 110	5 221	5 334	5 449	5 567	5 687	5 810	5 935	6 063	6 19

NOTA : Population in thousand people.

NIGER

CHART N°2 ER

MILLET AND SORGHUM SURFACES AND PRODUCTIONS

SOURCE : MINISTRY OF COUNTRY DEVELOPMENT

DEPARTMENTS	1977		1978		1979		1980		1981	
	Surfaces (000 ha)	Productions (000 T)	Surfaces	Prod.	Surfaces	Prod.	Surfaces	Prod.	Surfaces	Prod.
I. MILLET										
NIAMEY	840	272	821	297	881	328	933	325	804	322
DOSSO	512	197	600	211	603	219	605	247	604	256
TAHOUA	342	173	315	158	310	162	333	183	367	175
MARADI	411	209	451	224	515	241	580	289	613	265
ZINDER	580	243	530	226	572	293	581	303	603	285
DIFFA	44	16	30	7	41	13	40	15	46	17
TOTAL I	2 729	1 110	2 747	1 123	2 922	1 256	3 072	1 362	3 037	1 315
II. SORGHUM										
NIAMEY	78	27	86	52	82	44	88	42	81	38
DOSSO	29	12	56	21	54	17	43	20	45	19
TAHOUA	211	104	156	96	166	100	175	112	192	115
MARADI	199	81	244	90	234	82	238	70	412	82
ZINDER	200	90	233	92	157	84	197	91	230	68
DIFFA	148	20	20	20	23	22	27	32	22	13
TOTAL II	865	334	795	371	716	349	768	367	982	322
TOTALS I & II	3 594	1 444	3 542	1 494	3 638	1 605	3 840	1 729	4 019	1 637

NIGER

CHART N° 3 ER

MILLET AND SORGHUM PRODUCTION PROJECTION FOR THE NEXT 10 YEARS

(according to average 1977/1981 production of 1.582.000.T as a basis to start from)

MILLET AND SORGHUM PRODUCTION	1982	83	84	85	86	87	88	89	90	91	92
Total production M + S	(1614)	1 646	1 679	1 713	1 747	1 782	1 817	1 854	1 891	1 929	1 967
Production for consumption	(1372)	1 399	1 427	1 456	1 485	1 515	1 544	1 576	1 607	1 640	1 672

NOTA : Quantities in thousand metric tons.

NIGER

CHART N° 4 ER

MILLET AND SORGHUM CONSUMPTION

(in thousand metric tons)

POPULATION	Yearly consumption in kg per inhabitant	1983	84	85	86	87	88	89	90	91	9
Urban	150	135	143	151	161	170	180	190	201	212	2
Nomadic	190	152	154	156	158	160	162	165	167	169	1
Country	220	949	971	993	1 016	1039	1 063	1 087	1 112	1138	1
TOTAL		1 236	1 279	1 300	1 335	1 369	1 405	1 442	1 480	1 519	1
Average consumption per inhabitant		205,7	207,1	205	204,7	204,2	204	203,7	203,4	203,2	

REMARKS : According to the MARPLAN Study, the figure of about 190 kg a year per inhabitant is a reasonable average figure according to other sources, (5 year plan HOUEL SCETAGRI Study), higher figures could be considered such as 240 kg for the country population and 180 for the urban population. However, here, we have to estimate the requirements in mills. It seems safer to underestimate the needs, since otherwise production should be still higher, which is an unrealistic view.

CHART N° 5.ER

IMPORT LICENCES STATEMENT - GRAIN GRINDERS IN NIGER
(FIVE LAST YEARS)

SOURCE : MINISTRY OF TRADE

YEAR	OCTOBER	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPT.
76/1977	4	13	8	6	5	13	12	9	8	6	5	12
77/1978	25	18	17	19	22	18	15	31	19	23	22	29
78/1979	19	22	25	21	26	38	23	45	21	18	15	27
79/1980	20	15	24	31	33	35	26	28	28	39	22	23
80/1981	20	30	23	43	51	36	21	19	25	11	14	30
81/1982	23	30	25	22	16	48	40	27	31	21	29	24
Oct 82	23											

CHARTS NIGERIA STUDY

BAUCHI	[illegible]	2360	1154	[illegible]	[illegible]	[illegible]	[illegible]	4032	4137	4277	4422	4574	4731	[illegible]	[illegible]	[illegible]	[illegible]
					[illegible]	[illegible]	[illegible]	[illegible]	2659	2775	2793	2863	2935	[illegible]	[illegible]	[illegible]	[illegible]
					[illegible]	[illegible]	[illegible]	[illegible]	1473	1502	1629	1711	1796	[illegible]	[illegible]	[illegible]	[illegible]
BENUE	4339	3302	1043	2,5 %	4331	4439	4763	4913	5067	5227	5393	5564	5742	5926	6117	6314	6519
				5	3365	3565	3766	3918	3736	3829	3925	4023	4124	4227	4333	4441	4552
					1096	1154	1207	1258	1331	1398	1468	1541	1618	1699	1784	1873	1967
KADUNA	5913	4376	1537	2,5 %	6099	6293	6491	6631	6913	7135	7365	7603	7849	8106	8371	8645	8930
				5	4485	4583	4712	4830	4951	5075	5202	5332	5465	5602	5742	5885	6032
					1614	1698	1779	1858	1962	2060	2163	2271	2384	2504	2629	2760	2898
KANO	8332	7082	1250	2,5 %	8571	8819	9074	9336	9608	9888	10177	10476	10783	11102	11430	11769	12120
				5	7259	7441	7627	7817	8013	8213	8418	8629	8844	9066	9292	9524	9763
					1312	1378	1447	1519	1595	1675	1759	1847	1939	2036	2138	2245	2357
NIGER	1724	1104	620	2,5 %	1783	1944	1907	1973	2040	2111	2184	2261	2341	2423	2509	2598	2691
				5 %	1132	1160	1189	1219	1249	1280	1312	1345	1379	1413	1449	1485	1522
					651	684	718	754	791	831	872	916	962	1010	1060	1113	1169
PLATEAU	2924	702		2,5 %	3015	3103	3206	3305	3410	3518	3629	3744	3864	3987	4116	4249	4387
				5 %	2278	2334	2393	2453	2514	2577	2541	2707	2775	2844	2915	2988	3063
					737	774	813	853	895	941	988	1037	1089	1143	1201	1261	1324
[illegible]	[illegible]	4977	1572	2,5 %	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
				5 %	5101	5229	5360	5494	5631	5772	5916	6064	6216	6371	6530	6694	6861
					1651	1733	1820	121	2006	2107	2212	2323	2439	2561	2689	2823	2964
KWARA	2474	1556	918	2,5 %	2559	2647	2733	2834	2932	3034	3142	3252	3367	3487	3612	3742	3876
				5 %	1595	1635	1676	1778	1760	1804	1850	1896	1943	1992	2042	2093	2145
					964	1012	1063	1115	1172	1230	1292	1356	1424	1495	1570	1647	1731
TOTAL POPULATION	35769				36894	38038	39232	40467	41744	43069	44440	45861	47332	48857	50433	52074	53771
TOTAL COUNTRY POPULATION		26969			27644	28335	29044	29770	30513	31275	32057	32859	33681	34523	35386	36270	37178
TOTAL URBAN POPULATION			[illegible]		9249	[illegible]	[illegible]	[illegible]	11231	11794	12383	13002	13651	14334	15052	15804	16593

NIGERIA

CHART N° 2. IA

MILLET AND SORGHUM PRODUCTION

(1980/1982 Projection)

MILLET AND SORGHUM PRODUCTION	Discounted yearly procession rate	(basis) 1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	199
MILLET PRODUCTION	2 %	3 300	3 366	3 433	3 502	3 572	3 643	3 716	3 791	3 866	3 944	4 023	4 1 3
SORGHUM PRODUCTION	4 %	3 750	3 900	4 056	4 218	4 387	4 562	4 745	4 935	5 132	5 337	5 551	5 7 3
TOTAL PRODUCTION (Millet + sorghum)		7 050	7 266	7 489	7 720	7 959	8 205	8 461	8 726	8 998	9 281	9 574	9 876
yearly increase			3.06	3.07	3.08	3.09	3.09	3.12	3.12	3.12	3.15	3.15	3.1
Production for consumption (85 %)		5 992	6 176	6 366	6 562	6 765	6 974	7 192	7 417	7 648	7 889	8 138	8 395

NOTA : Quantities in thousand metric tons
calculations based on millet and sorghum production statement

CHART . N° 3.IA

NIGERIA

MILLET AND SORGHUM CONSUMPTION CHART

POPULATION OF THE STATES	YEARLY CONSUMPTION PER INHABITANT	1983 EN 000 T	1984	1985	1986	1987	1988	1989	1990	1991	1992
URBAN	115 KG	1 292	1 356	1 424	1 495	1 570	1 648	1 731	1 817	1 908	2 004
COUNTRY	165 KG	5 035	5 160	5 289	5 422	5 557	5 696	5 839	5 985	6 134	6 288
TOTAL CONSUMPTION		6 327	6 516	6 713	6 917	7 127	7 344	7 570	7 802	8 042	8 292
AVERAGE CONSUMPTION PER INHABITANT		151,6	151,3	151,1	150,8	150,6	150,3	150,1	149,8	149,6	149,3

NIGERIA

CHART.N° 4.IA

SUMMARY OF DISC GRINDER SURVEY

DEPOT	GRINDERS REPORTED	POPULATION REPORTED 000	INDIVIDUAL GRINDER CAPACITY t/yr2	TOTAL GRINDER CAPACITY III t/yr	ESTIMATED GRAIN CONSUMPTION 000 t/yr3	POPULATIO 0004
Gusau	25	563	274	6.8	77.6	157
Badeggi	6	2	638	Negligible		
Kaduna	558	217	228	127.2	37.8	600
Kano	163	600	191	31.1	115.2	660
Otiskum	43	80	821	35.3	11.4	98
Ilorin	249	496	468	116.5	49.1	400
Oyo	217	250	234	50.8	14.8	138
Benin	15	325	47	.7	7.5	259
Enugu	324	274	1092	386.6	4.1	439
	1630	2807				

Notes : 1. Survey did not differentiate between grinders and rice dehullers
2. Calculated from survey with 1 mudu = 2 ½ kg
3. Based on 1969 per capita consumption by state (74)
4. Extrapolation of 1963 city census at 1952 to 1963 growth rates (60)
5. Grinders also used for cassava.

(Feasibility study on food grain processing in NIGERIA - June 1978)

NIGERIA

CHART. N° 5.IA

MILLING MACHINERY IMPORTS

YEAR	ITEMS	WT. X 10^3	VALUE X 10^3		Pds/App
1975	2670	1, 371 kg	N 2, 551	Page 167	49 kg
1974	1191	791 kg	N 1, 604	Page 151	66 kg
1973	959	963 kg	N 1, 709	Page 148	100
1972	3771	2, 638 lb	1, 298	Page 151	350
1971	8798	3, 548 lb	1, 289	Page 156	156
1970	1360	862 lb	799	Page 141	317
1969	1322	225 lb	57	Page 136	85
1968	2224	473 lb	141	Page 138	106
1967	7998	923 lb	297	Page 140	58
1966	2829	2, 708 lb	572	Page 126	478
10 year total	33122	18, 251 lb			276

1. Nigerian Trade Summary, Federal Office of Statistics, Lagos, 1966 - 1975

Using the limited machine throughput data available from the survey, it is fair to say that the grinding requirements of the urban centres are being met or exceeded by the samall engine-driven plate grinders. Thus, any penetration of the urban milled grain market would require a flour that offered some advantages over that currently available. This superiority might take form in :

MILLS AND DEHULLERS

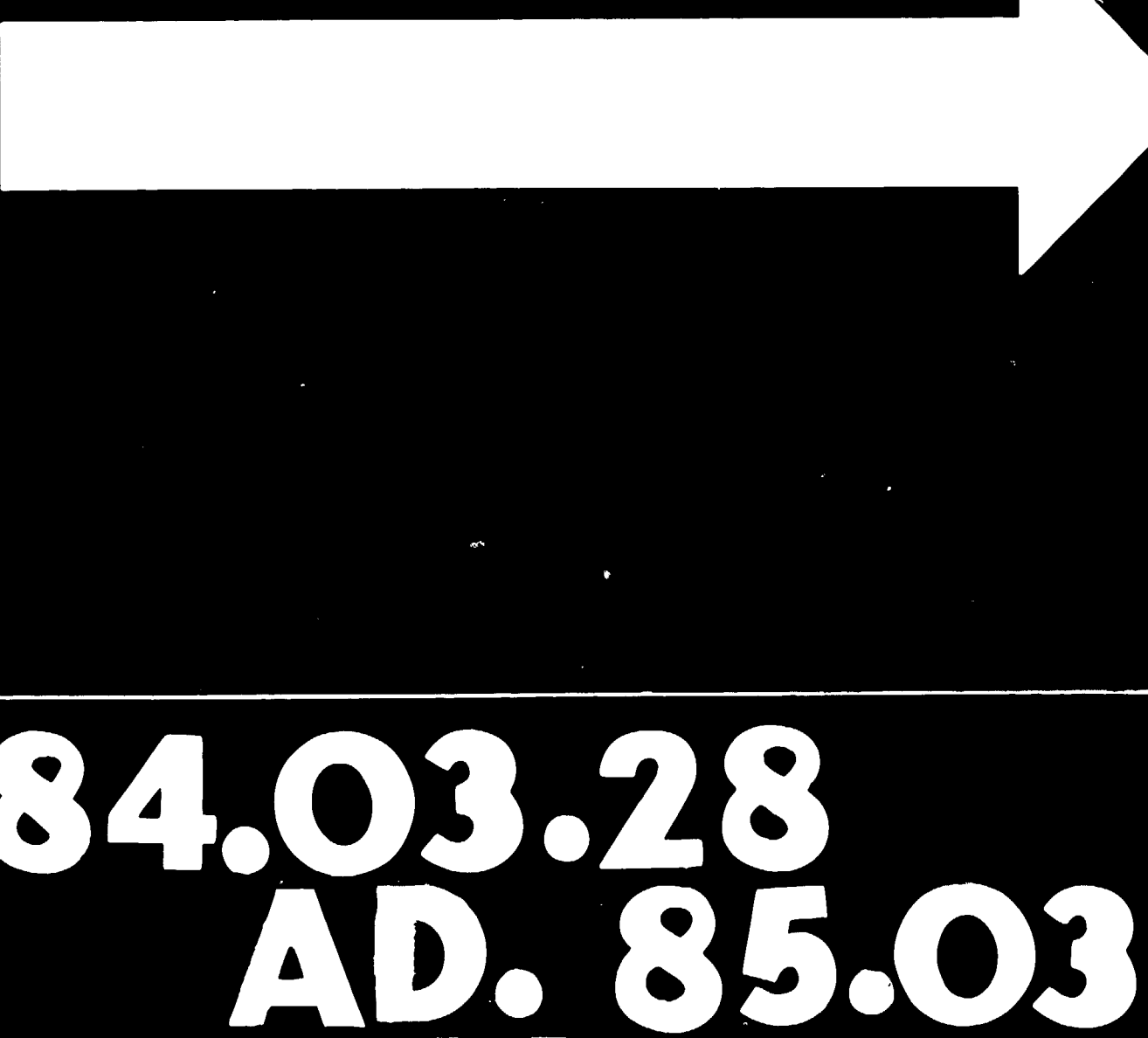
- Lists with addresses of mill manufacturers
  (this list is not exhaustive)

- Descriptive brochures concerning some plate mills
  Remarks : the BENTALL, SUPERB and HUNT types
  1A and 2A have been met on various occasions
  in NIGER and NIGERIA.
  The same is true of the Indian RAJAN TRADING CO. Model
  AMUDA type.

- Descriptive brochure of MINI DEHULLER IDRC

- Plans 1 to 7 - MINI DEHULLER IDRC

- Letter from LEWIS C. GRANT whose dehuller type is used,
  especially in towns in NIGER, for the dehulling of millet and
  sorghum.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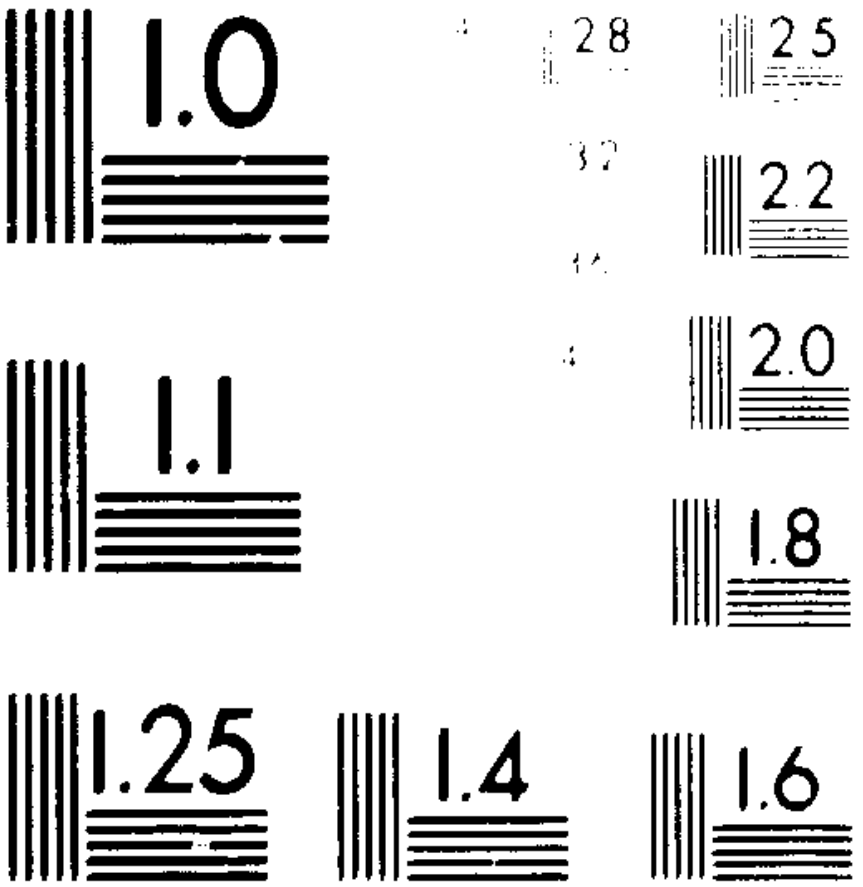


CHART N° 6

PRINCIPAL MILLS MANUFACTURERS

COUNTRY	BRAND	ORIGIN	MODEL	MILL TYPE	Engine Power Rating	Through-put kg/h	Speed (rpm)
GREAT BRITAIN	BENTALL	Maldon	200 L 090	Cast iron Plates	5 CV	227/272	600
GREAT BRITAIN	HUNT	Colchester	N° 1	Cast iron Plates	4CV/5CV	180	550 650
			N° 2	"	6CV/7CV	270	550 650
FEDERAL REPUBLIC GERMANY	IRUSWERKE	Dusslingen		Stone	2 CV	100	-
BELGIUM	Ateliers ALBERT	Namur			7,5 CV	250-300	-
BELGIUM	D D D President	Ypres	Range of mills	Natural stone grindstones	0,5 CV à 15 CV	25 à 800	-
CHINA	Chinese Brand		6 F Z 308	Hammers	-	200-400	4600
DANEMARK	A.B.C. HANSEN	Copenhaguen	Diamond	Artificial stone grindstones	1 CV	-	-
			Farmers Favourite		-	-	-
			Diamond		5-15 CV	300-1000	-
DANEMARK	SKIOLD		S B	Hammers	-	300	3.800
			K.K.E. 16	"	-	300-400	-
INDIA	RAJAN TRADING CO	Madras	AMUDA FLAT PLATE MILL N° 1	Stone	5-6 CV	200	600 650
			AMUDA DOMESTIC MILL	"	0,5 CV	18	-
INDIA	DANDEKAR Brothers	Maharashtra		Natural stone Grindstones	6- 8 CV	250	-
JAPAN	CECOCO	Universal Impact Pulverizer	Range of mills	Hammers	0,5 à 20 CV	20 à 900	-

Chart. n° 6 (continued)

COUNTRY	BRAND	ORIGIN	MODEL	TYPE MILL TYPE	Engine Power Rating	Through-put kg/h	Speed (rpm)
FRANCE	RENSCM et Cie	59 Landrecies	le MODERNE	Flint stones	4-5 CV	200-300	-
F	LAW	60 Senlis	B.P. 15	Hammers Mill	7,5 CV	150-250	-
F	TOY et Cie	41 Montdrie	"Multi broie tout"	Hammers	5 CV	150 kg	3000
F	CHAMPENOIS	52 Chevillon	V 300	Corundum or Metal plates	4 CV	200-300	600 à 700
		"	V 400	Corundum or Metal plates	5,5 CV 7,5 CV	250-350	500 à 600
		"	C L B	Metal	3,5/7CV	60/200	500/1000
F	FAO Sté COMIA-FAO	B A 318	35 Vitrified	Vitrified Corundum plates	5 CV	70kg/h	750
		B M T 4000		Hammers	8-10 CV	120kg/h	4000

MILL MANUFACTURERS' ADDRESSES

ARARA	30, rue d'Anjou - 78000 VERSAILLES (FRANCE)
BENTALL	Ptd Heybridge Works Maldon Essex (ANGLETERRE)
CECOCO	Chuo Boeki Goshi Kaisa - P.O. Box 8 - Ibaraki City OSAKA Préf. 567 (JAPON)
CHAMPENOIS	Chamouilley - 52170 CHEVILLON (FRANCE)
DANDEKAR	Biwandi - Dist. Thana, MAHARASHTRA (INDE)
FAO	Boulevard Chateaubriand - 35500 VITRE (FRANCE)
HUNT	ATLAS WORKS - Earls Colne Colchester Essex CO6 2 EP (ANGLETERRE)
LAW	5, Avenue du Général de Gaulle - 60304 SENLIS (FRANCE)
RENSON	59550 LANDRECIES (FRANCE)
TOY	B.P. 10 - 41800 MONTOIRE (FRANCE)

DEHULLER MANUFACTURERS' AND RESEARCH
CENTRE'S ADDRESSES

- LEWIS C GRANT LTD	KY1 2UA DYSART FIFE SCOTLAND
- I.D.R.C. (International Development Research Centre)	BP 8500 - OTTAWA CANADA K 1 G 3 H 9

TECHNICAL DATA SHEETS

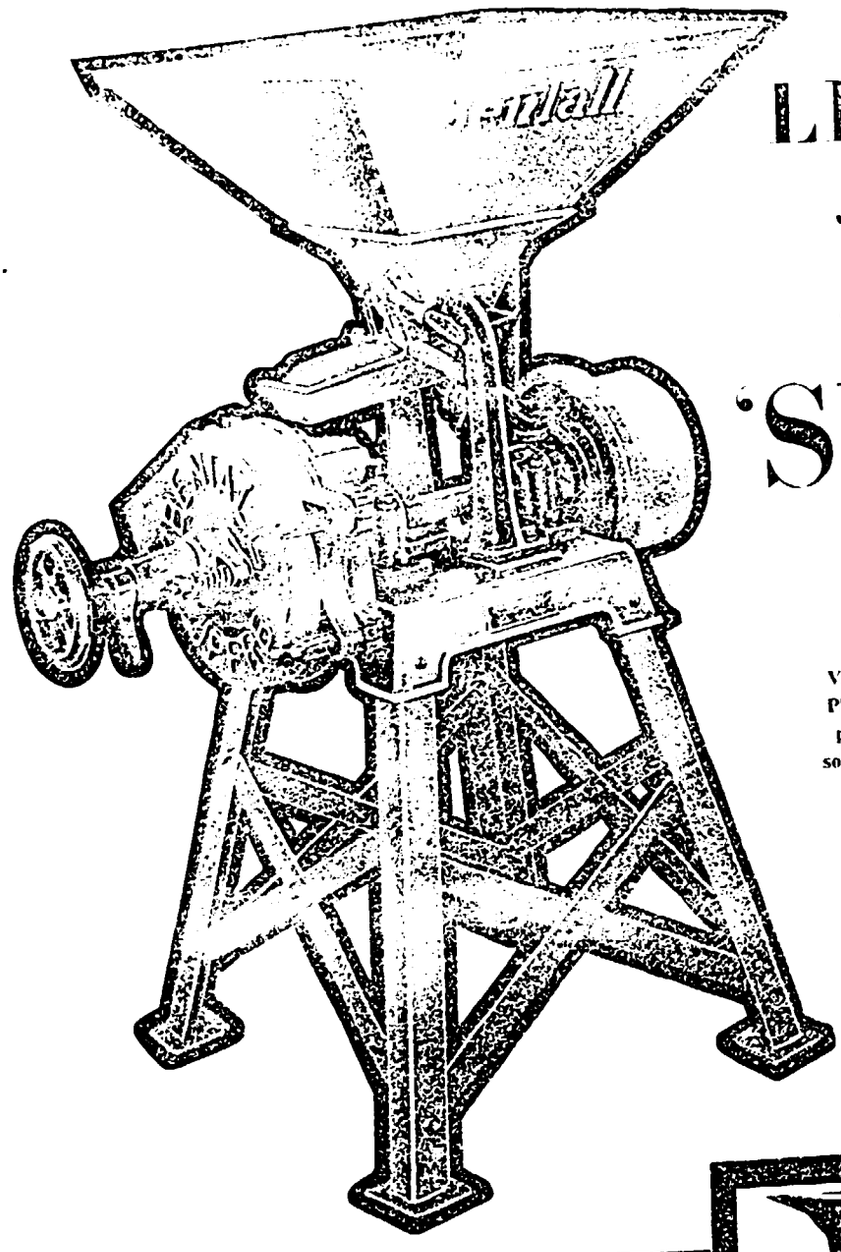
MILLS :

- BENTALL, models SUPERB 200 & SUPREME
- CHAMPENOIS, models CLB - V 300 - V 400 & "NOVA" - "JUNIOR"
- FAO, model BA 318
- HUNT, models n° 1A & 2A

DEHULLERS :

- LEWIS G. GRANT, models 2-4-8
- IDRC, PRL mini dehuller

LE MOULIN Bentall 'SUPERB



Voici l'adjonction de date récente à la gamme de Moul
Plaque Bentall de renom mondial, modèle réalisé spéciale
pour les marché; d'outremer. Cette machine est extrême
soliée et peut être aisément démontée pour l'emballage. T
les parties principales sont en fonte et en acier et tout
pièces mécaniques s'appuient sur roulements à bil
fonctionnent sans accroc pendant de longues année
plaques à moudre de 26 cm. 70 de diamètre sont à ra
fines, permettant ainsi de réaliser d'une façon satisfaisa
mouture du maïs sec et moulu, froment, orge, avoin
L'ajustage de la roue régulatrice en bout du fuseau p
d'obtenir une mouture soit fine soit grossière. La ch
de mouture est facilement accessible grâce au couve
charnières tandis que sa construction assure qu'il
pratiquement pas de résidu après la mo

SPECIFICATION

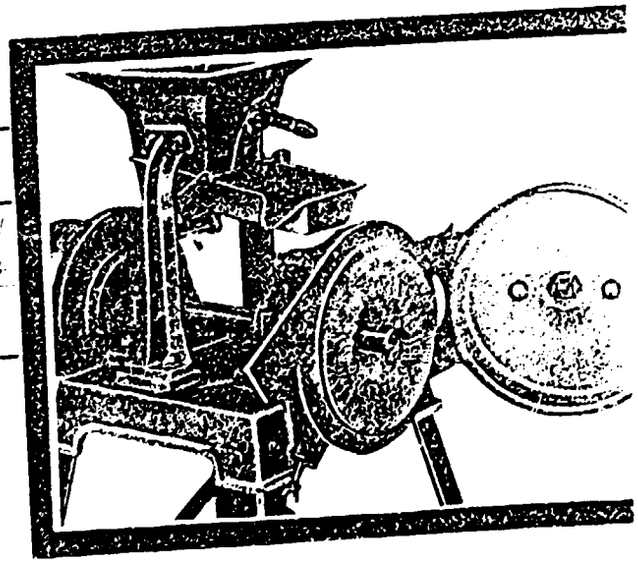
Moulin No.	*Diam. Plaques*	*Cv nécess.*	*Vitesse recommandée*	*Grandeur de la Poulie*	*Rendement/ heure environ, kg.*
200	26 cm. 70	5	600 t.p.m.	254 mm. · 114 mm. 30	227-272

Dimensions d'Encombrement

Longeur 940 mm · largeur 660 mm. · hauteur 1m 422

Poids et Mesures

Poids net:	136 kg.
Poids brut:	239 kg.
Dimensions de la caisse:	838 mm. · 610 mm. · 660 mm.

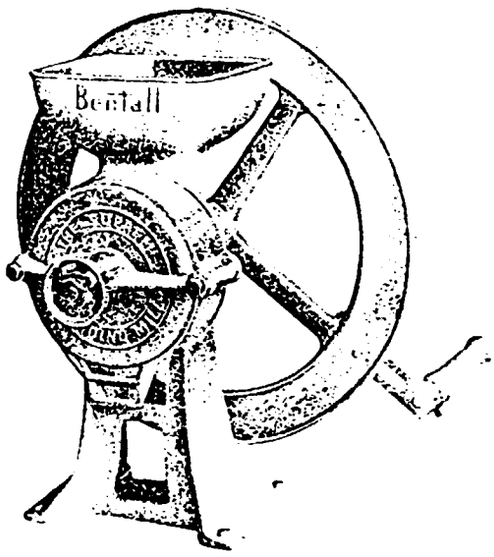


BENTALL "SUPERB"

SPECIFICATION

Mill N°	Plates Diameter	HP required	Recommended speed	Pulley size	Approximate yield kg/h
200	26,7 cm	5	600 r.p.m.	254 mm x 114 mm 30	227-272

MOULIN BENTELL "SUPREME"



pour moudre du froment en farine entière pour pain complet.

Les usagers se rendront compte de ce que ce moulin est un moyen efficace de moudre le blé fin pour tous besoins ménagers. Le froment et d'autres céréales sont moulues rapidement et aisément pour donner une farine extrêmement fine et unie.

TOUTES LES CEREALES peuvent être moulues, y compris le café et les épices, les plaques pouvant être ajustées pour la mouture bise ou pour l'égrugeage. L'adjustment se fait au moyen d'une roue régulatrice montée au bout du fuseau.

LES PLAQUES A MOUDRE sont en métal de mélange dur spécial Bentall, de construction brevetée: flexible, à réglage automatique qui assure leur parfait centrage mutuel.

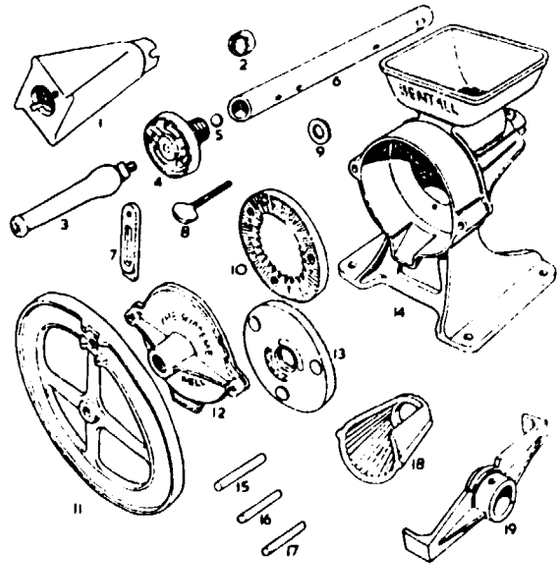
LE MOULIN peut être boulonné sur une table ou banque en bois ordinaire ou bien sur une table en fonte à pieds en acier, livrable sur demande et facturée en sus. (Voir l'illustration.)

LES PLAQUES A MOUDRE et toutes les pièces à usure sont aisément remplacées une fois usées. Dans la construction du moulin nous n'employons que les meilleurs matériaux et la meilleure fabrication, avec finissage attrayant par une bonne application de peinture protectrice.

Diamètre des plaques:	140 mm.
Capacité de la trémie:	¼ boisseau
Poids du moulin:	30 kg.

POIDS ET MESURE D'EMBALLAGE

Mesures	*Poids* NET Kgs	BRUT Kgs
Sans support d'établi 6 moulins complets dans une caisse à claire-voie 965 mm. × 737 mm. × 584 mm. (0,42m³)	191	241
12 moulins complets dans une caisse à claire-voie 1m 72 × 737 mm. × 610 mm. (0,94m³)	381	470



RENDEMENT MOYAN DES CEREALES PRINCIPALES

Rendement approximatif par heur

DENREE	*Mouture*	*Egrugeage*
Froment	6,80 kg.	22,77 kg.
Maïs	6,80 kg	27,22 kg.
Fèves	6,80 kg.	27,22 kg.
Pois	4,54 kg	27,22 kg
Riz	6,80 kg	27,22 kg
Cafe	3,18 kg	

PIECES DE RECHANGE

No. sur Dessin	*Désignation*	*Pièce No.*
1	Cône concasseur	30095.C.
2	Bouton	20209.C.
3	Group Manivelle de Commande	15558
4	Groupe Vis de réglage manuel	20136.C.
5	Bille, 12,5 mm.	
6	Fuseau principal	30097.C.
7	Allongement de manivelle	4038
8	Vis ailée	
9	Rondelle pour manivelle de Commande	
10	Plaque à moudre (fixe)	40078.C.
11	Roue à main	40081.C.
12	Couvercle supérieur	40080.C.
13	Plaque à moudre rotative	40079.C.
14	Bâti	50050.C.
15	Cheville cannelée 6 mm. diam. × 39 mm.	
16	Cheville cannelée	
17	6 mm. diam. × 35 mm.	
18	Boîte à cone concasseur	40077.C.
19	Cliquet de commande	30096.C
	Vis de plaque à moudre (3)	20141.C.
Poids de moulin		35 kg.
Poids du support d'établi		13 kg.

E. H. BENTALL & CO., LTD., HEYBRIDGE WORKS, MALDON, ESSEX, ANGLETERRE

Câblogrammes: BENTALL, HEYBRIDGE, ANGLETERRE

Téléphone: MALDON 801 (6 lignes)

Printed in England 11461/ETH/2M 1/60 (F)

BENTAIL SUPREME MILL

AVERAGE YIELDS ON MAIN GRAIN

Approximate yields (kg/h)

Rawstuff	Fine Milling	Coarse Milling
Wheat (Maize)	6,80	22,77
Corn	6,80	27,22
Broad beans	6,80	27,22
Peas	4,54	27,22
Rice	6,80	27,22
Coffee	3,18	27,22

MOULINS V300 & V400

Les moulins **V. 300 et V. 400** réalisés entièrement en mécano-soudure sont les plus modernes et les plus pratiques.
La conception de leur bati permet de placer une brouette métallique ou un chariot de service directement sous la sortie de mouture.
Les meules en corindon vitrifié d'une extrême résistance peuvent être examinées instantanément. Le réglage de la meule mobile est très précis et n'exige aucun effort. Le diamètre des meules est respectivement de 300 et de 400 mm.

MISE EN PLACE

La machine doit être autant que possible installée sur un sol de niveau. Si l'installation est à poste fixe, sceller l'appareil au sol.

MISE EN ROUTE

La vanne d'alimentation du moulin doit être fermée et le moulin vide lors de la mise en marche.

RACCORDEMENT ELECTRIQUE ET TRANSMISSION

Nos machines livrées avec moteur électrique sont toujours connectées en étoile sur voltage maxi, un schéma de branchement est joint à chaque appareil.
La puissance du moteur est de 4 Ch. pour le V. 300 , de 5,5 Ch. ou 7,5 Ch. pour le V. 400.
Lorsqu'ils sont livrés sans moteur, les moulins V. 400 et V. 300 peuvent être équipés d'une poulie plate ou d'une poulie à gorges (en option voir tarif). La vitesse de la poulie doit se situer entre: 600 et 700 t/mn pour le V. 300
500 et 600 t/mn pour le V. 400
Ces moulins peuvent aussi être commandés par prise de force du tracteur. La puissance plus grande permet des rendements supérieurs.

REGLAGE DES MEULES

L' oche et le recul de la meule mobile se fait au moyen des trois leviers à poignée sphérique solidaires du palier mobile. Un tour complet représente un déplacement de 1,5 mm soit 0,5 mm par levier. Au préalable, il faut desserrer la vis de blocage de collier arrière. Un témoin de positionnement permet de retrouver instantanément la position initiale.
Éviter le contact des deux meules.

REGLAGE DU DEBIT

Il se fait en fonction de la finesse de la mouture désirée, par l'écartement des meules. Une vanne visible par le hublot sur le côté du distributeur permet de régler avec précision la descente du grain.

POULIES ET COURROIES

Les courroies trapézoidales doivent être tendues sans excès. Au fur et à mesure de l'usure des meules, réaligner les poulies en desserrant la vis de blocage de la poulie de la meule.
Les poulies sont en option dans le tarif.

CHANGEMENT DES MEULES

Lorsque les meules seront usées, leur remplacement sera nécessaire. A la commande, préciser le diamètre extérieur ou le type du moulin (V. 400 ou V. 300).
Démonter les meules usées, nettoyer les faces d'appui, installer les nouvelles meules, serrer progressivement chaque boulon de [illegible] et ne les bloquer sans exagération que lorsque tous

La trémie d'une capacité de 60 litres est complètée par une vanne de réglage avec voyant de contrôle de débit.

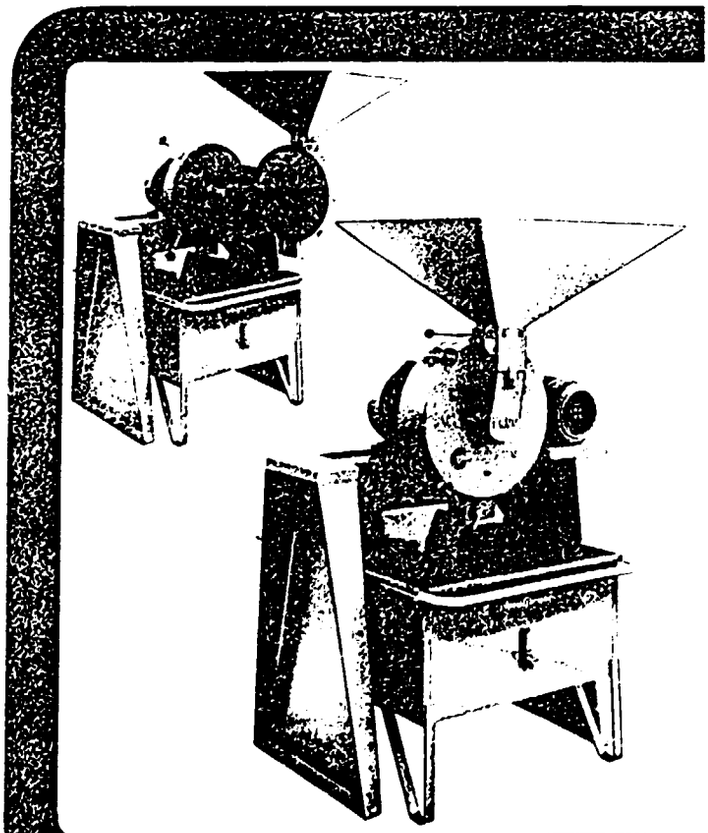
Peuvent-être fournies avec ou sans moteur.
Peuvent-être fournies avec ou sans poulies.

Puissance des moteurs et débits horaires en kg.

	V 300	V 400	V 400
MOTEURS	4 ch.	5,5 ch.	7,5 ch.
INTENSITE	9/12 A	12/18 A	25/30 A
ORGE	300/370	350/450	500/580
BLE	300/370	350/450	700/800
MAIS	300/400	600/700	700/800

OUVERTURE DU MOULIN

Deux petits volants assurent la fermeture du moulin. Il suffit de les desserrer de quelques tours et de les écarter pour ouvrir le carter du moulin. On peut ainsi s'assurer rapidement de l'état des meules.



POIDS NET

MOULIN V. 300	avec moteur 140 kg
	sans moteur 104 kg
MOULIN V. 400	avec moteur 155 kg
	sans moteur 121 kg

DIMENSIONS HORS TOUT

HAUTEUR	1,50 m
LONGUEUR	1,19 m

CHAMPENOIS V300 AND V400 MILL

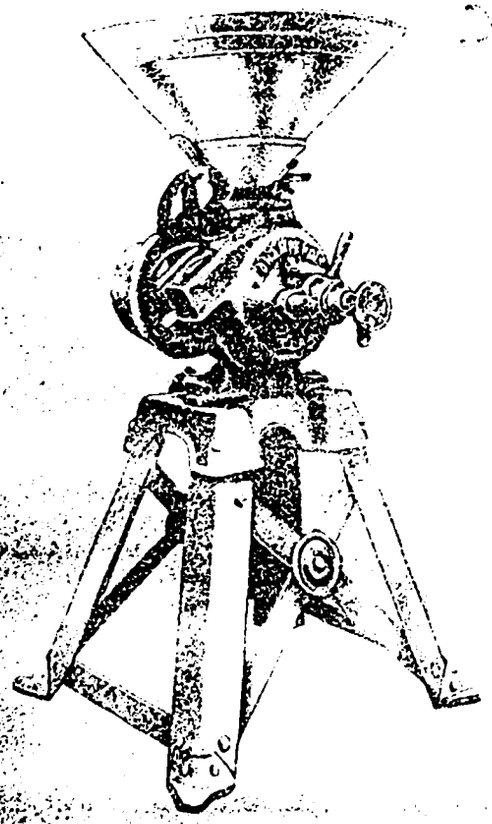
MOTORS POWER RATINGS AND HOURLY YIELDS (IN KG)

	V 300	V 400	V 400
Motors	4 HP	5 HP	7,5 HP
Intensity	9/12 A	12/18 A	25/30 A
Barley	300/370	350/450	500/580
Wheat	300/370	350/450	700/800
Corn (maïze)	300/400	600/700	700/800

champenois

MOULIN CONCASSEUR

CLB



- MOULIN SIMPLE ET ROBUSTE
- BROIE TOUTES GRAINES: BLE ORGE, AVOINE, SEIGLE, MAIS ET PRODUITS DIVERS, TOURTEAUX, CHARBONS, ETC...
- SE LIVRE SUR PIEDS ET BATI OU SUR SOCLE SANS PIED
- GRAND DEBIT

CARACTERISTIQUES

Marque	FORCE selon vitesse	POULIE de commande	VITESSE à la minute	DEBIT HORAIRE APPROX. Concassage	Mouture	MEULE diamètre	POIDS approx.
CLB	3 1/2 à 7	D 250 x L 110	500 à 1.000	350 à 600 kg	60 à 200 kg	260 mm	150 kg

NOTA. — Sur demande, la grande trémie ronde en tôle peut être remplacée par une embase de trémie carrée en fonte qui permet de recevoir une rehausse en bois de contenance au choix ; mais cette dernière n'est pas fournie.

Les **débits** sont variables en raison des nombreux facteurs qui concourent à leurs résultats : vitesse, force motrice disponible, nature et état de la graine traitée, degré de finesse de mouture désirée. Il est important de ne traiter que des graines sèches ; des grains humides encrassent les meules et ne donnent aucun rendement.

Le débit est proportionnel à la vitesse ; il est donc préférable de faire tourner l'appareil le plus près possible de la vitesse de 1.000 tours indiquée ; néanmoins à partir de 5 à 600 tours, le moulin CLB, donne déjà un excellent résultat : nous recommandons au moins 650 t. p. m.

IMPORTANT. — Eviter que la sortie de la mouture soit gênée par le sac qui doit la recevoir.

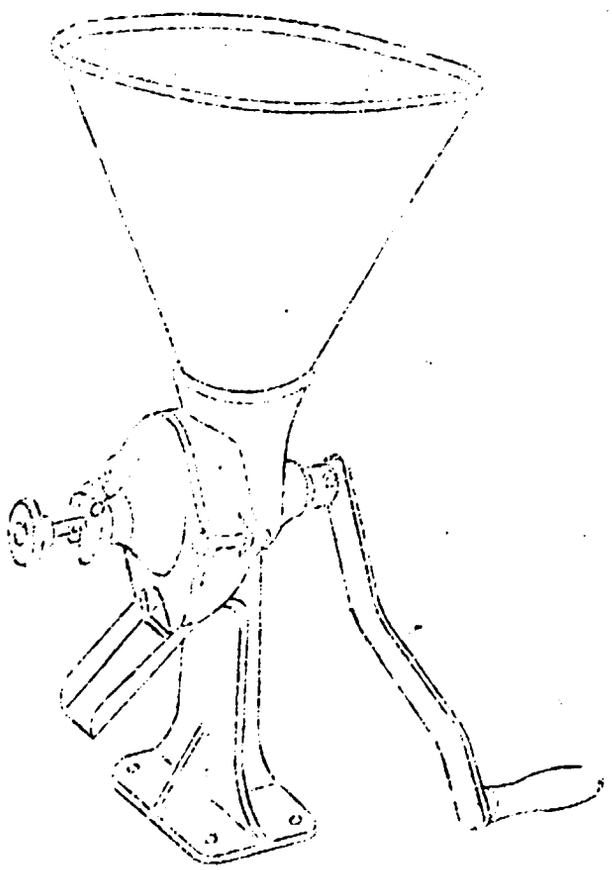
CHAMPENOIS CLB MILL

CHARACTERISTICS

Brand	POWER according to speed	PULLEY size	SPEED Rpm	APPROX. HOURLY YIELD Coarse Milling	Fine Milling	PLATE diam.	Approx. WEIGHT
C L B	3 ½ to 7	D250xL110	500 to 1.000	350 to 600 kg	60 to 200 kg	260 mm	150 kg

CHAMPENOIS

MOULIN CONCASSEUR "JUNIOR"



PETIT MOULIN FAMILIAL

Peut moudre et concasser toutes graines, blé, orge, maïs, mil etc... de même que tous produits divers et pharmaceutiques

Meules en fonte acièrée extra-dure

REGLAGE SIMPLE ET FACILE

DEBIT HORAIRE APPROXIMATIF

Blé	:	25 à 30 litres.
Avoine	:	20 à 22 litres.
Orge	:	24 litres.
Maïs	:	24 litres.

CARACTERISTIQUES

Motion à bras.

Meules de 95mm

Poids 7 kg

ETS CHAMPENOIS
S.A. Capital : 1.400.500 Frs.
COUSANCES-LES-FORGES (Meuse)

R.C. : BAR-LE-DUC : 58-B-14

Tél : 103.

CHAMPENOIS "JUNIOR" MILL

APPROXIMATE HOURLY YIELD

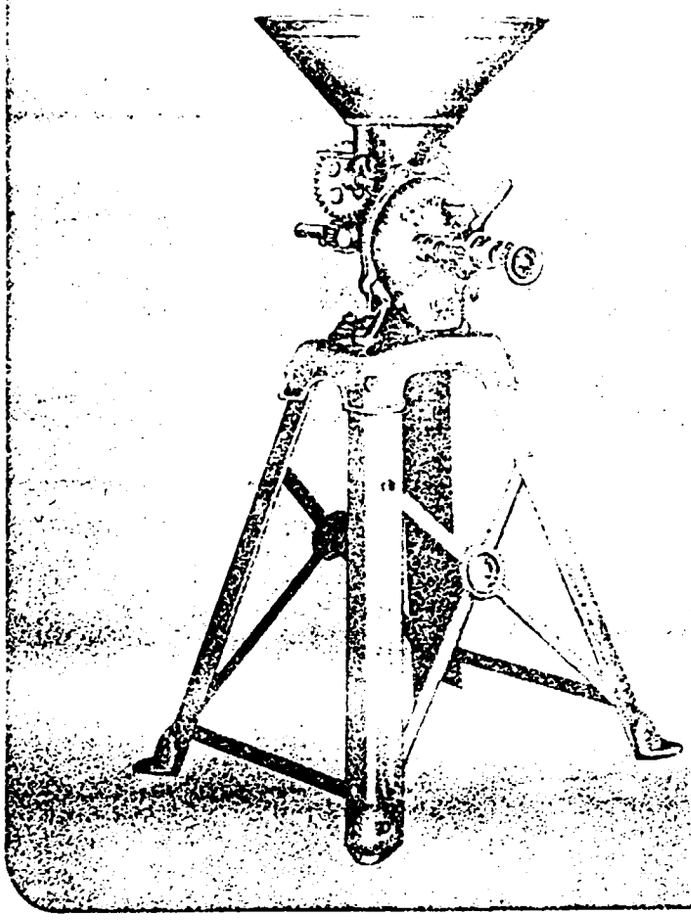
Wheat	:	25 to 30 liters
Oats	:	20 to 22 liters
Barley	:	24 liters
Corn (maïze)	:	24 Liters

CHARACTERISTICS

Hand operated

95 mm diameter plates

Weight 7 kgs



- SE LIVRE :

  SUR PIEDS ACIER
  SUR SOCLE, SANS PIED

  MEULES PLATES
  REVERSIBLES
  DIAMETRE : 160 mm

- SUR DEMANDE :

  POULIE-VOLANT :
  DIAMETRE 150 mm

  VITESSE RECOMMANDEE
  AU MOTEUR :
  500 A 600 t/m

CARACTERISTIQUES

Poids sur pieds, volant et manivelle : 62 kilos

Force requise au moteur 2 CV 1/2 à 3 CV.

DEBIT approximatif à l'heure

à bras	35 kilos
au moteur	350 kilos

Le Moulin « **NOVA** » est livré normalement sur pieds acier avec volants et manivelle. Sur demande, il peut recevoir une poulie-volant et être livré avec ou sans pied pour fonctionner au moteur ; dans ce cas, le volant n'est pas nécessaire.

Les meules sont réversibles, c'est-à-dire qu'elles peuvent être utilisées sur les deux faces. Le montage à rotule de la meule mobile assure une application toujours parfaite des deux meules.

SE LIVRE :

« **NOVA** » modèle A, complet sur pieds fer, volant et manivelle ou poulie.
« **NOVA** » modèle B, sur socle spécial, sans pied , avec poulie-volant, ou poulie.

Champenois

Chamouilley 52170 CHEVILLON
Tél. (25) 05. 20. 44 et 05 23. 37
Télex REMAGRI N° 840914 F
SIRENE 515 780 682 000 16

CHAMPENOIS "NOVA" MILL

CHARACTERISTICS

Can be delivered :

on steal stand
on base, without stand

Flat, reversible plates
diameter 160 mm

On special order :

Pulley-flywheel
Diameter 150 mm

Motor recommended speed :
500 to 600 rpm

CHARACTERISTICS :

Weight, with stand, flywheel and crank : 62 kgs
Motor power requirements : 2 ½ to 3 HP
Approximate hourly yield :
Hand-operated : 35 kgs/h
Motor operated : 350 kgs/h

FAO MOULIN à MEULES Type BA 318

POUR LA PRODUCTION
DE PÂTE D'ARACHIDES
DE FARINE (mil, sorgho, maïs)

Meules en corindon vitrifié

Carter de broyage en fonte avec porte sur charnière

Trémie capacité 40 litres

Système d'alimentation par trappe couvrante avec trembleur permettant de régulariser le débit

3 formules d'entraînement :
Moteur thermique essence
Moteur thermique Diesel
Moteur électrique avec démarreur ΔΔ
Ampèremètre de contrôle et disjoncteur

Transmission par courroies trapézoïdales poulies à gorges avec carter de protection

Réglage de finesse par volant à encoches avec taquet d'immobilisation.

VITESSE DE ROTATION : 750 t/mn

PUISSANCE MOTEUR
- Electrique 4 cv
- Thermique 5 cv ou 6 cv

Réf. A36

FAO
Société COMIA - FAO S.A.
27, Bd de Châtecubriant
35500 VITRÉ (FRANCE)
Tél. (99) 75-20-97
Télex : 950 457 F
R.C. Rennes 77 B 101

FAO

MOULIN BA 318

DESCRIPTION

C'est un MOULIN à MEULES, Type B 31, Vitesse de rotation : 750 Tr/mn.

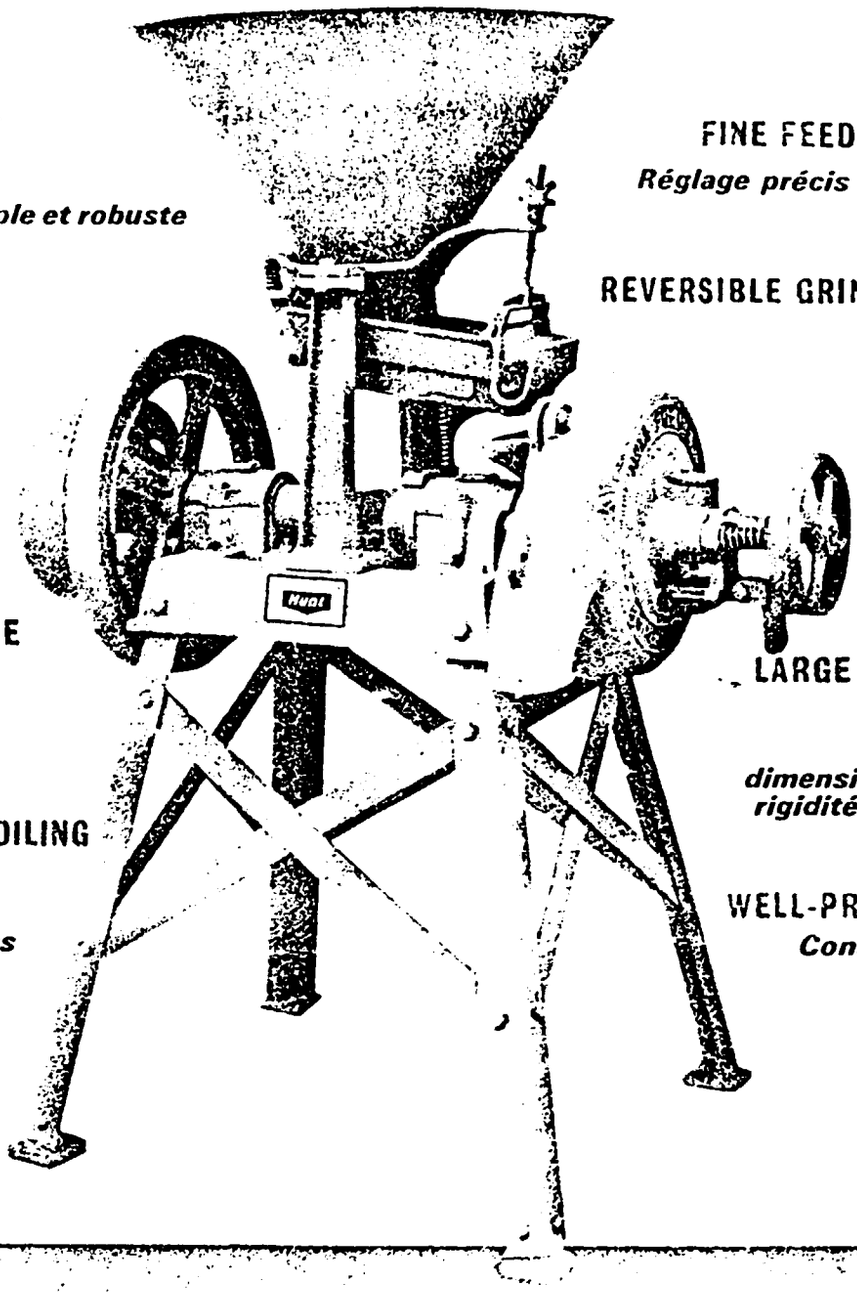
Il est formé :
- d'une TREMIE en tôle conique, capacité 40 Litres.
- d'un système d'ALIMENTATION avec TREMBLEUR.
- d'une CARCASSE en fonte, avec porte ouvrante sur charnières, permettant une visite rapide des meules.
- d'un BATI en mécano-soudure.

Le système d'alimentation avec trappe de réglage est équipé d'un trembleur assurant une bonne régularité du débit d'alimentation.

De plus, une grille permet la retenue des pièces métalliques et des cailloux qui peuvent être contenus dans les céréales.

Les 2 meules Ø 300, épaisseur 40 mm, sont en corindon vitrifié. La meule fixe est solidaire de la porte au moyen de 3 vis. La meule mobile est munie de râcleurs, permettant la sortie de la farine. Elle est fixée sur un plateau monté oscillant sur l'arbre, afin de conserver en permanence le parallélisme des faces de travail des 2 meules, élément indispensable pour l'obtention d'une farine régulière.

La variation de finesse s'obtient en réglant l'écartement des meules. Ce réglage est réalisé par la rotation du volant à encoches. Un taquet assure ensuite son immobilisation et évite ainsi tout déréglage.



SIMPLE, ROBUST CONSTRUCTION

Construction simple et robuste

FEW WEARING PARTS

Peu de pièces d'usure

EASY TO OPERATE

Facile à utiliser

ENCLOSED RING-OILING BEARINGS

Paliers étanches bagues lubrifiantes

FINE FEED ADJUSTMENT

Réglage précis d'alimentation

REVERSIBLE GRINDING PLATES

Plaques de broyage reversibles

LARGE SPINDLE FOR RIGIDITY

Broche bien dimensionée assure la rigidité de l'ensemble

WELL-PROVED DESIGN

Construction bien éprouvée

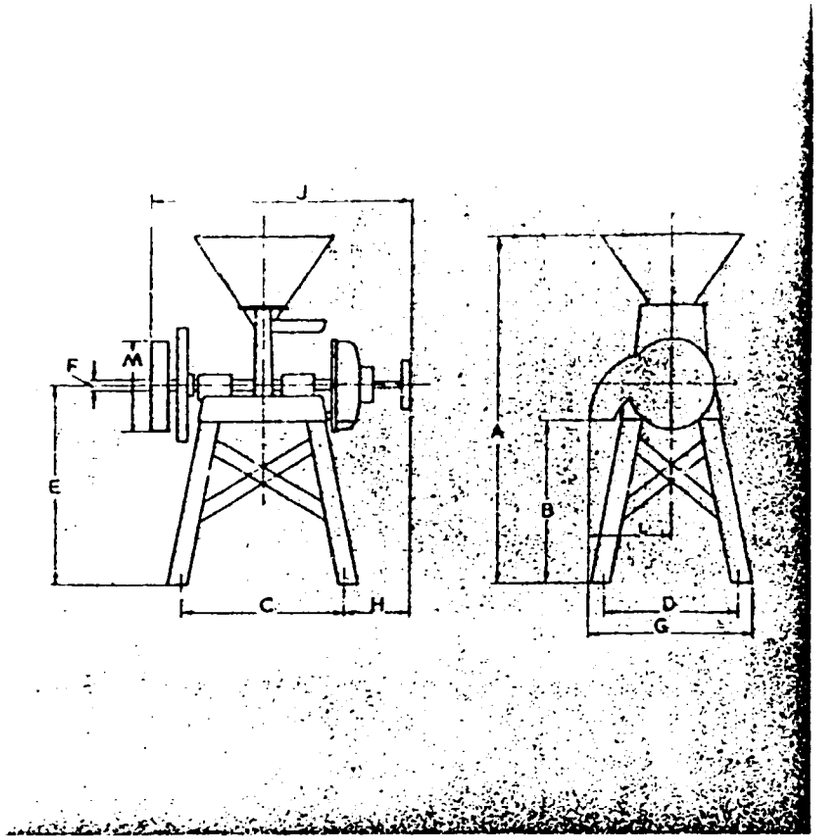
Hunt

Premier grinding mills

Suitable for wheat, barley, beans, spices, rice, cocoa, coffee, wet and dry maize, etc.

broyeurs Premier

Recommandés pour: blé, orge, fèves, épices, riz, fèves de cacao, café, maïs sec et humide, etc.



The outputs given are for mills producing medium samples, and output will always depend on the material being ground and the sample required.

LES BROYEURS "PREMIER" sont pour broyage de matières sèches et humides. Les débits indiqués pour les différents modèles s'entendent pour un degré moyen de pulvérisation.
Le débit restera toujours fonction de la matière broyée et du degré de pulvérisation requis.

GRINDING PLATES are made from special hard-wearing iron and are reversible. Medium grinding plates are supplied as standard and are suitable for all normal applications. Other types of grinding plates for special applications can be supplied if details of the duty are given. Only genuine HUNT plates should be purchased as spares.

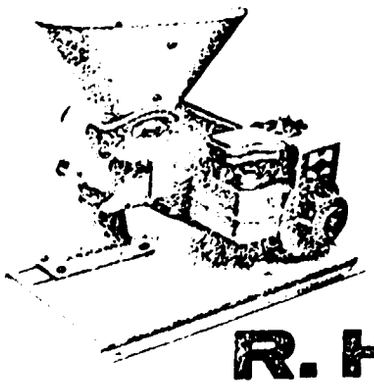
LES PLAQUES BROYEUSES sont faite-en acier spécial résistant à l'usure et reversibles. Les plaques du type moyen sont fournies avec le matériel ou l'équipement standard et utilisables pour tout emploi normal.
D'autres types de plaques pour applications spéciales sont disponibles sur demande en fonction du genre de travail envisagé. Comme plaques de rechange n'utiliser que les pièces fabriquées par HUNT.

PREMIER MILLS are robust and simple to operate, with few wearing parts. Moving parts easily lubricated with oil. Recent modifications, including the use of metric bolts, allow interchangeability of spares with older machines.

LES BROYEURS "PREMIER" sont caractérisés par leur construction très robuste, leur facilité d'utilisation et le peu de pièces d'usure. Les pièces en mouvement sont faciles à lubrifier avec de l'huile. Les modifications récentes y compris l'introduction de boulons de dimensions métriques permettent l'interchangeabilité des pièces avec les machines plus anciennes.

MILL	Speed rev/min	DRY MATERIAL MATIÈRE SÈCHE			WET MAIZE MAIS HUMIDE		
BROYEUR	Vitesse t/min	H.P C.V.	Approx. output lb/hr.	Débit approximatif kg/hr.	H.P C.V.	Approx. output lb/hr.	Débit approximatif kg/hr.
1A	550-650	4-5	400	180	5-6	250-300	115-135
2A	550-650	6-7	600	270	8-10	300-400	135-180

BROYEUR	A in pouces mm	B in pouces mm	C in pouces mm	D in pouces mm	E in pouces mm	F in pouces mm	G in pouces mm	H in pouces mm	J in pouces mm	L in pouces mm	Standard Pulley Poulie Standard in/pouces mm	Reversible Grinding Plate diam. Plaque Broyeuse Reversible diam. in/pouces mm
1A	50 1270	24 610	24⅛ 613	19⅝ 499	28¾ 730	1½ 38	24 610	10½ 267	39 991	12 305	10×3½ 254×89	10 254
2A	54 1372	23¾ 603	27⅓ 692	22 559	29 737	1¾ 45	28 711	12½ 318	46¾ 1187	15 381	12×4 305×102	12 305



PREMIER 127

PLATE GRINDING MILL

Only requires 1 to 2 h.p.
Output 100 lb (50 kg.) per horsepower
Hand feed auger for fine control.
Ask for leaflet No. 3352 for full details.

PREMIER 127

BROYEUR À PLAQUES

Puissance d'entrainement seulement 1 à 2 CV.
Débit 50 kg par CV
Alimentation manuelle par vis sans fin assurant réglage précis.
Pour renseignements complémentaires demander le prospectus no. 3336.

R. HUNT & CO. LTD

ATLAS WORKS, EARLS COLNE, COLCHESTER, ESSEX, CO6 2EP, ANGLETERRE

Téléphone: EARLS COLNE 2032 (STD Code 078-75) Telex: 98285

P.R.L. "MINI" DEHULLER

INSTRUCTION MANUAL

A.E. YORK

NATIONAL RESEARCH COUNCIL

PRAIRIE REGIONAL LABORATORY

SASKATOON, SASKATCHEWAN

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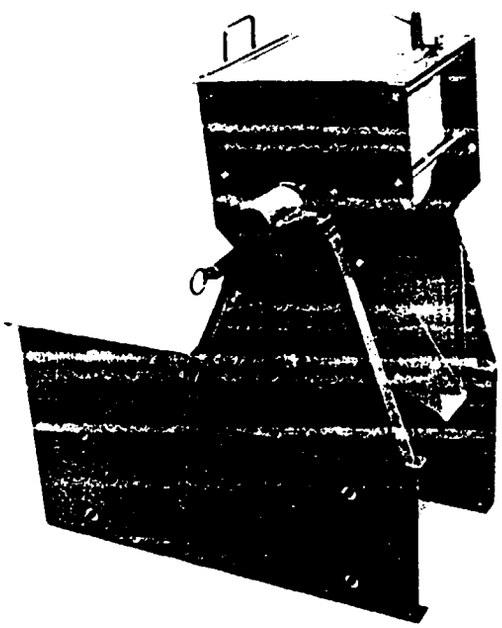
P.R.L. "MINI" DEHULLER



FORWARD

The P.R.L. "MINI" DEHULLER was developed to fill the need for a small batch-type machine in rural communities. It was understood that people in these communities preferred to have their own grain processed, thereby retaining their own dehulled grain and the bran fraction, if desired. Since its development, research centres have found a need for a simple dehuller of this size to help stimulate the production and use of locally grown cereals. Commercial milling establishments also are showing interest in using this size of machine to provide local consumer service.

1.1. DEHULLING PRINCIPLE

The P.R.L. "Mini' dehuller uses the same basic principle as large, abrasive-type commercial machines in milling establishments. That is, a series of abrasive stones are fixed on a shaft, mounted in a case, and rotated in a bed of grain.

Inexpensive resinoid steel cut-off disks or carborundum stones provide the abrasiv effect. The disks are made of aluminum oxide abrasive, bonded by plastic into very thin, light, strong sections, that can be rotated safely at speeds of 6400 r.p.m. Eight disks are mounted between spacers on a shaft, with the end disks canted 8°. The canted disks provide continual mixing and additional abrasive contact area for dehulling. When carborundum stones are required the canted disks are retained. However, the 6 disks in the middle are replaced by only 4 of the stones. This assembly is mounted in a case with a hinged top, where the grain to be dehulled is placed. Dehulling is performed by rotating the shaft assembly at a selected speed for a desired time. To remove the contents the case is rotated to the dumping position and the hinged top is unlatched. The mixture of dehulled grain and bran flows out by way of a chute into a collection bucket.

1.2. OPERATING R.P.M.

Various grains and cereals have been dehulled satisfactorily in the P.R.L. "MINI" DEHULLER, by operating between 1600-2000 r.p.m. Select your operating r.p.m. within this range. Breakage will be minimized if 2000 r.p.m. is not exceeded. It may be necessary to experiment with several r.p.m.'s to select one suitable for local grains. The harder types of grains will require a longer dehulling time to produce an acceptable product.

The following table provides dehulling times and extraction rates for a variety of grains using the P.R.L. "MINI" DEHULLER at 1675 r.p.m. and a standard 15 pound (6.8 kilos) load.

	Species	Dehulling Time/Min.	% Kernel Removed
LEGUMES			
	Soybean	2	11.3
	Fababean	1	16.7
	Field Pea	1	12.7
	Lentil	1	14.6
	Kidney bean	2	15.8
	Mung bean	3	25.8
	Black eyed Cow Pea	2	20.4
	Brown Cow Pea	3	26.3
CEREALS			
	Wheat	3-6	6.7-22.9
	Brown Rice	1-3	8.3-16.3
	Millet	1-3	5.0-10.4
	Sorghum	2-6	11.3-27.4

2.0 ASSEMBLY

NOTE

The P.R.L. "MINI" DEHULLER was designed and built using Imperial standards. Therefore, as an aid, all Imperial references will be followed by the metric equivalent in brackets.

The dehuller has been disassembled into distinct sections for packaging and shipping. Assembly requires an adjustable wrench (spanner) which is provided. Instructions are intended to be simple and are aided by references to figures. To aid in assembly and reduce the possiblity of loss, all nuts have been welded to components.

2.1.. STAND

Identify and collect the following parts using fig. 1 for reference.

- two sides, which are 12 inches (305 mm) wide x 32 inches (813 mm) long, having the two longest edges bent.
- two spreaders, which are 11 inches (279 mm) wide x 16 1/2 inches (419 mm) with all edges bent.
- eight hexagonal bolts - 3/8 inch (9.5 mm) dia. x 1 inch (25.4 mm) long.
- eight flat washers - 3/8 inch (9.5 mm)

Taking one side, place the widest bent edge down. Using the bolts and washers provided, attach the spreaders to the sides as shown in fig. 1 and 2, with all bent edges facing inward. The remaining side is attacned to the spreaders in simular fashion.

NOTE - leave all bolts loose.

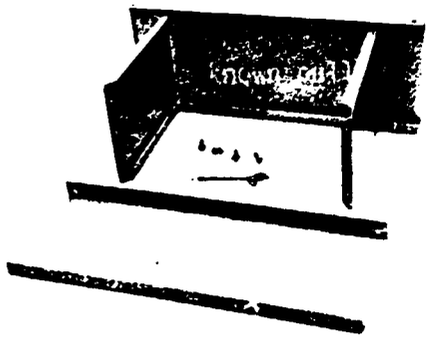


fig. 1

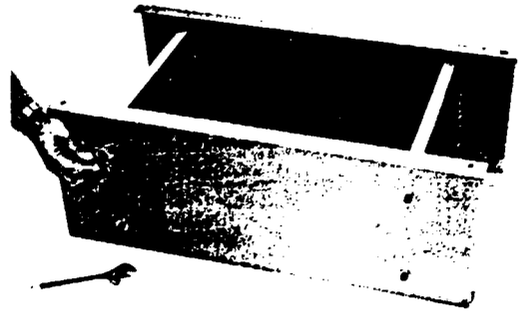


fig. 2

2.2 FRAME

This section is the largest and heaviest, consisting of channels, bearing frames, a motor base, and grain chute, all welded together. A locking pin and bracket is bolted to one of the bearing frames (fig. 3). The locking pin is spring loaded and is operated by pulling on the ring.

Place the frame section (fig. 3) on top of the narrow bent edges of the stand. Shift the stand sides until all holes align. If thy do not, lift and turn the frame section end for end. Bolt the two sections together using four 3/8 inch (9.5 mm) dia. x 1 inch (25.4 mm) hexagonal bolts with washers. After the bolts are in place, tighten all bolts securely.

2.3 CASE

The remaining section is the case complete with hinged top. Two self aligning bearing pillow blocks are mounted on a shaft which passes through the case.

Position the case on the frame (fig. 4) by pulling the locking pin outward, sliding the case into approximate position, and releasing the locking pin, thereby engaging one of the two holes on the side of the case. Four 3/8 inch (9.5 mm) x 1 1/2 inch (38 mm) hexagonal bolts with washers are used to fasten the case section and shaft guard to the frame. Do not tighten the bolts. Loosen the two bolts holding the locking pin bracket to bearing frame. Align the case by rotating from loading to dumping position and back until the locking pin engages both holes freely. Tighten all bolts.

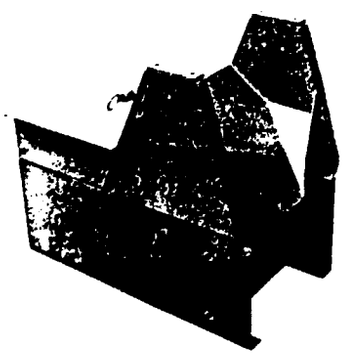


fig. 3

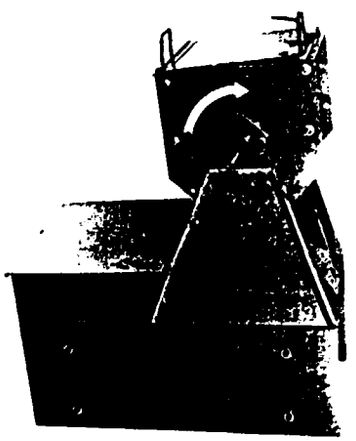


fig. 4

3.0 INSTALLATION

3.1 POWER SOURCE

POWER REQUIREMENTS - minimum for the P.R.L. "MINI" DEHULLER ARE:

- 3 h.p. for an electric motor (1400-1800 r.p.m.)
- 5 h.p. for a petrol or diesel engine.

NOTE - the "MINI" was designed for mounting of a power unit with the output shaft on either left or right side of the frame.

DEHULLER SHAFT ROTATION - refer to fig. 5 and the section drawings on pages 25 and 26 for proper shaft rotation, as it may not be marked on the dehuller case.

IMPORTANT - the shaft assembly must be installed in the case correctly. When looking at the shaft assembly in the case from the dehuller front (chute end is front), the large hexagonal nut must be on the right hand side. Correct shaft rotation tightens the nut on the shaft.

3.2 PULLEY SIZES

The following must be known to aid in selecting pulleys for the dehuller and power unit:

- dehuller operating r.p.m. = O
- power unit " " = P
- pitch diameter of pulley = p.d.

1. Electric Motor

(a) without a known pulley size

$\frac{O}{P}$ = p.d. ratio of both pulleys

(b) with a known pulley size for motor

$\frac{P \times p.d.}{O}$ = p.d. of pulley for dehuller

(c) with a known pulley size for dehuller

$\frac{O \times p.d.}{P}$ = p.d. of pulley for motor

2. Petrol or Diesel Engine

The BALL-LOK clutch will operate with two V-belt widths.

A- width = 1/2 inch (12.7 mm) - p.d. is 4.4 inches (112 mm).

B- width = 5/8 inch (16 mm) - p.d. is 4.7 inches (119 mm)

$\frac{O \times p.d.}{P}$ = p.d. of pulley for engine

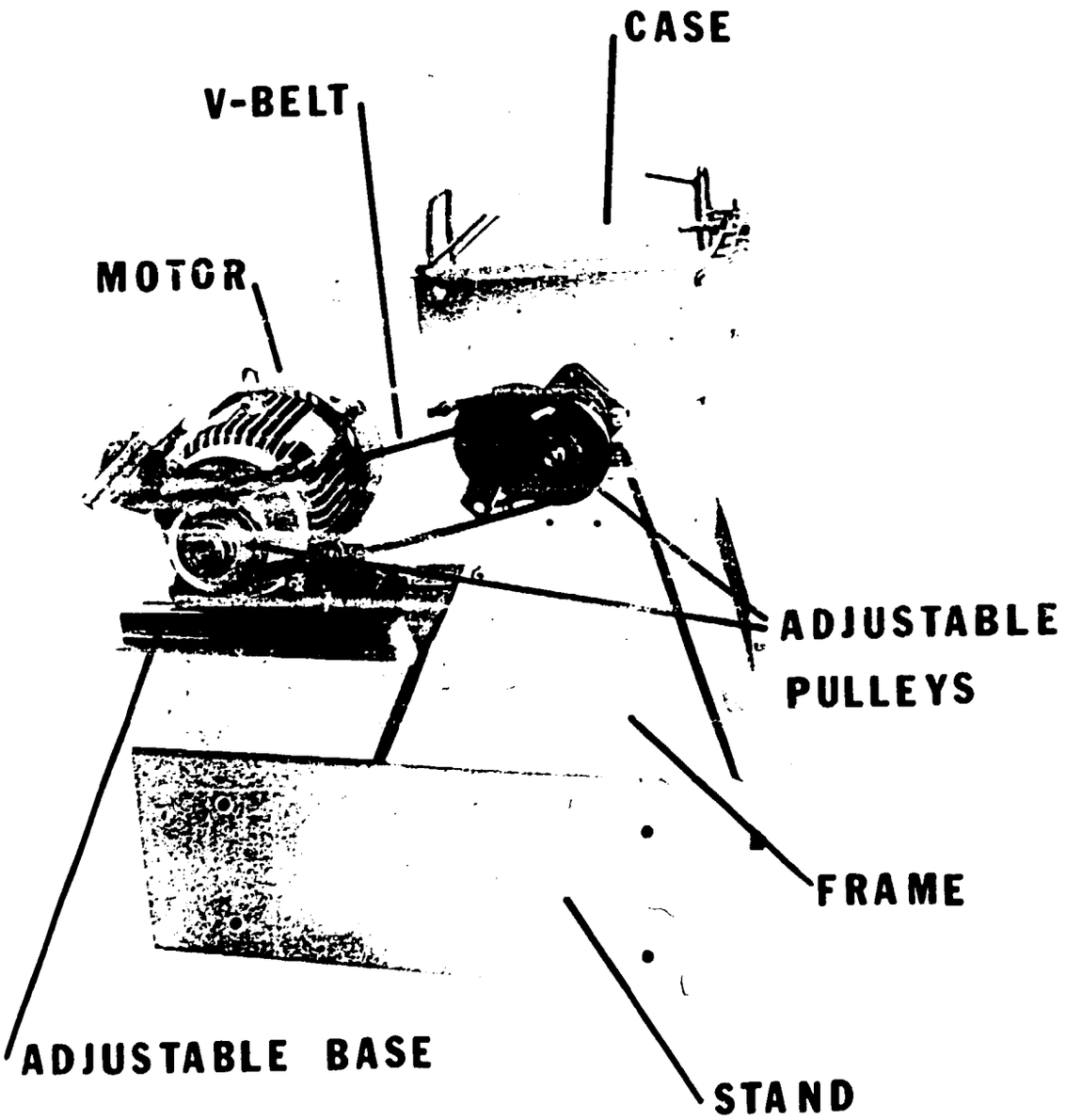

CASE
V-BELT
MOTOR
ADJUSTABLE
PULLEYS
FRAME
ADJUSTABLE BASE
STAND

Fig. 5

3.3 MOUNTING

The bottom bent edges (widest) of the stand have holes to accept 3/8 inch (9.5 mm) bolts, for fastening to heavy wooden skids or to a concrete floor. Hole spacing is approximate 15 inches (381 mm) x 30 inches (762 mm). Simplicity suggests placing the dehuller where desired, marking the hole position, and proceeding to mount securely.

3.4 ELECTRIC MOTOR

An electric motor installation is the simplest, ensuring trouble free operation providing that the power source is reliable. Motor wiring as well as reversing of shaft rotation can be performed by a qualified electrician following the motor wiring instructions on the motor and complying with local standards.

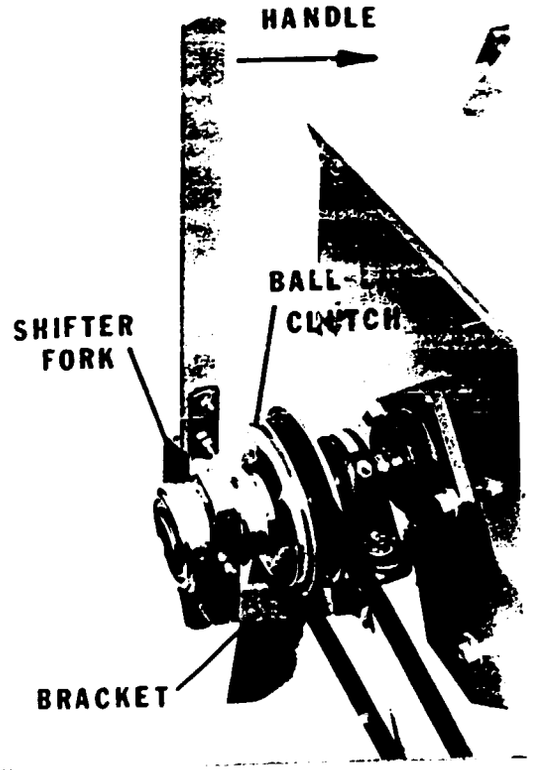


fig. 6

NOTE - the BALL-LOK clutch assembly (handle, shifting fork and bracket) is not required when an electric motor is used.
REMOVE.

Refer to section 3.2 to determine the pulley sizes needed to deliver desired dehuller r.p.m. Use of two adjustable pulleys gives some r.p.m. variation. Mount the motor loosely midway on an adjustable motor base. This will provide belt tensioning. Place on dehuller motor base area (fig. 7). Slide pulleys with keys onto shafts, do not tighten. Place V-belt over pulleys and shift motor to a satisfactory position. Mark the adjustable motor base holes on the dehuller with a pencil and remove motor and base. Drill holes of suitable size at the marked location.

Replace the electric motor and base on the dehuller and bolt base securely in place. With the V-belt on the pulleys, slide the pulleys in or out as required for proper belt alignment. Tighten the pulley set screws. Set the belt tension, using the adjusting screw on the motor base. Secure the motor to the adjustable base by tightening the four hold down nuts. The electric motor can now be wired to the start/stop switches and power supply. Check for proper dehuller shaft rotation; if incorrect, reverse by following motor wiring instruction. Dehuller r.p.m. can be increased or decreased if required by turning the adjustable portion of one pulley in and that of the other out, and locking in place by tightening the Allen set screws.

NOTE - it may be necessary to move the Locking Pin assembly and shaft guard. They should be on the side opposite the pulleys.

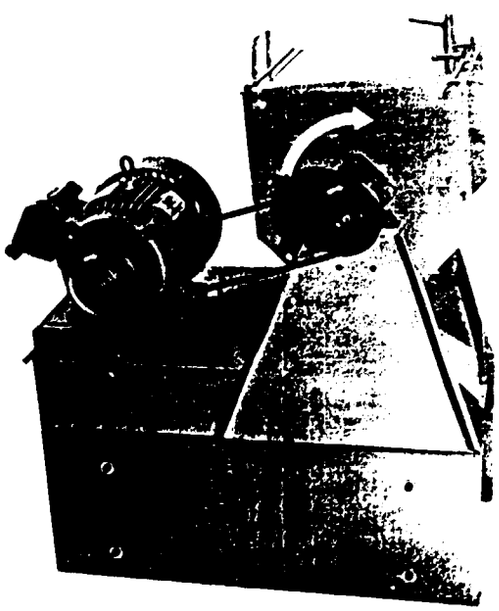


fig. 7

3.5 PETROL OR DIESEL ENGINE

The engine can be placed on the dehuller motor base with the output shaft on either side, to provide proper dehuller shaft rotation. Included is a BALL-LOK clutch which allows one to start and stop the dehuller with the engine running. To provide proper shaft rotation, it may be necessary to relocate the following:

1. BALL-LOK clutch - assembly (handle, shifter fork and bracket) (fig. 6) to the same frame side as engine output shaft.

2. Shaft Guard and Locking Pin assembly to frame side opposite that of the BALL-LOK clutch.

Slip the selected pulley on the engine shaft, (refer to section 3.2 for pulley size). A V-belt of suitable size is placed over the BALL-LOK clutch and engine pulley. Shift engine until location is satisfactory. Mark the engine mounting holes on the dehuller motor base with pencil, and remove engine from dehuller. To provide for belt tension adjustment, the drilled holes on the dehuller motor base are made into slots (fig. 8). After slotting the dehuller replace the engine and V-belt. Shift the motor backward to provide sufficient belt tension and bolt down securely. To ensure proper BALL-LOK clutch operation refer to section 6.3, which provides instructions for V-belt alignment.

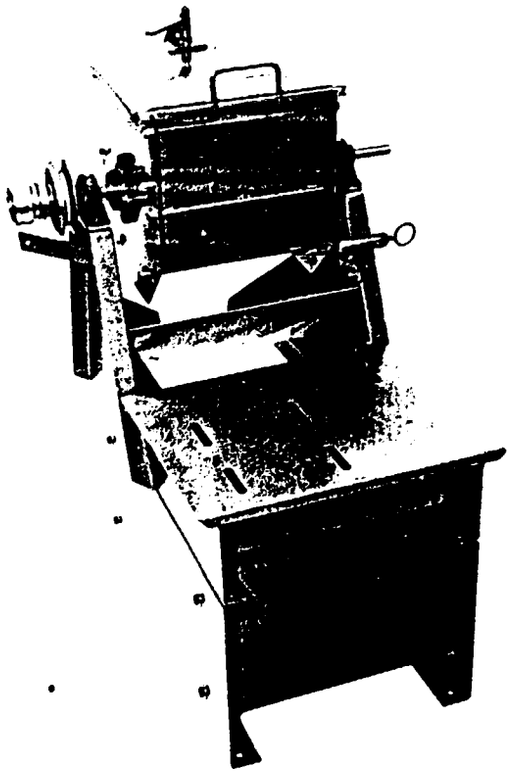


fig. 8

3.6 CENTRALLY LOCATED DIESEL

Continuous and service milling operations may have a need to install a P.R.L. "MINI" DEHULLER in their facilities to provide a consumer service. Mills which are electrically powered will encounter no problems in installation. The governing factor would be a suitable area.

In rural areas, complete mills may be powered mechanically from a single centrally located diesel. This type of operation uses jack shafts, pulleys and belts of various sizes to deliver power to each machine. Installing the "MINI" dehuller into this type of operation, requires technical knowledge and mechanical ability. Power transfer, proper dehuller r.p.m. and correct shaft rotation must be considered.

Use the BALL-LOK clutch on the dehuller with two pillow block self-aligning bearings (such as part No. 21) and a short jack shaft approximately 30 inches (762 mm) long, bolted to the dehuller motor base. This will provide proper belt alignment and tension for the BALL-LOK clutch giving the dehuller a start/stop operation.

4.0 OPERATION

4.1 SAFETY

Familiarity, routine and high noise levels lead to operator carelessness and possible injury. Listed are a few safety suggestions:

1. Belt guards were not included in shipment and should be provided to cover all pulleys and belts.
2. No loose clothing should be worn by operators, clothing should be comfortable and form fitting.
3. Hearing protection should be worn if noise level is high.
4. Dust masks should be worn in dusty areas.

4.2 OPERATING INSTRUCTIONS

The grain to be dehulled should be precleaned to remove substantial amounts of dirt, stones and other foreign matter. Select and maintain a standard weight (6-7 kilos.) of grain for all batch dehulling. Tests were performed on the P.R.L. "MINI" DEHULLER using 15 pounds (6.8 kilos) as a standard weight.

1. Weigh out a standard amount of grain.
2. Check locking pin engagement.
3. Open hinged top of case.
4. Pour grain into case.
5. Close top, engage latch.
6. Start dehuller.
7. Stop dehuller after desired operating time.
8. Grasp case handle with one hand, disengage the locking pin with the other; rotate case forward to dumping position; engage locking pin in the other hole in side of case.
9. Unlatch the hinged case top, allowing the grain to flow out by way of the chute into a collection container (pail or bucket).

The mixture collected consists of dehulled grain and bran which must be separated by winnowing or screening.

5.0 MAINTENANCE AND REPAIR

5.1 REGULAR MAINTENANCE

These suggestions are of a preventative nature:

1. Clean regularly.
2. Occasionally check all bolts for tightness.
3. Check all nuts on the case side for tightness.
4. Check all Allen set screws for tightness on all pulleys, bearing collars.
5. Check nuts and bolts on BALL-LOK clutch shifter fork for tightness.
6. Lubricate BALL-LOK clutch regularly.
7. Check foam gasket between case and hinged top for deterioration, and replace if necessary.
8. Check mounting bolts on power unit for tightness.
9. Power unit - refer to manufacturers maintenance instructions.
10. Check V-belt for wear, and replace if needed.
11. Check resinoid disks or carborundum stones and shaft lock nut for tightness.

5.2 LUBRICATION

NOTE

Pillow and Flanged bearings are of a permanently lubricated type which do not require lubrication. These have lube fittings on them, but they are no longer functional. DO NOT LUBE ANY BEARINGS ON THE P.R.L. "MINI" DEHULLER.

If operators insist on trying to lube these bearings, remove fittings and discard.

BALL-LOK CLUTCH - has a lubrication fitting for a pressure hand gun. Use a quality lube such as Lubriplate. Lubrication is needed to keep sliding parts in good condition and should be frequent if operating in extremely dusty conditions.

POWER UNIT - refer to manufacturers instructions.

5.3 CASE GASKET REPLACEMENT

The gasket will need replacing when damaged or when it no longer provides a proper dust seal between case and hinged top. Included with the parts is a package of self-adhesive foam tape.

1. Remove all old tape and clean flanges on case and sides.
2. Cut two pieces of foam tape 12 inches (305 mm) long for the front and rear
3. Peel protective paper backing from one piece and firmly press adhesive side against rear case flange.
4. Repeat for front case flange.
5. Cut two pieces 13 1/4 inches (336 mm) long for case side flanges.
6. Apply one strip to each case side flange.

5.4 V-BELT REPLACEMENT

1. Slaken belt tension by loosening the power unit and moving it forward.
2. Remove BALL-LOK clutch shifter fork and handle (fig.6).
3. Slip worn V-belt off BALL-LOK clutch and power unit pulley.
4. Place a new V-belt over BALL-LOK clutch and pulley on power unit.
5. Replace shifter fork and handle on BALL-LOK clutch.
6. Tighten V-belt by sliding power unit back and securing solidly.

5.5 RESINOID DISK REPLACEMENT

It may be necessary to replace the resinoid disks if excessive disk wear or edge chipping is encountered.

1. Remove BALL-LOK clutch shifter fork and handle (fig. 6).
2. Slacken belt tension by loosening the power unit and shifting forward.
3. Remove V-belt.
4. Remove BALL-LOK clutch from shaft by loosening Allen set screw (fig. 9) and sliding off.
5. Remove the four bolts holding the pillow blocks and shaft guard to frame.
6. Remove shaft guard.
7. Loosen all Allen set screws on pillow block eccentric locking collars. (fig. 10).
8. Slide off locking collars (fig. 10).
9. Disengage locking pin and lift case off frame.

fig. 9

fig. 10

10. Loosen <u>both</u> Allen set screws on flanged bearing (fig. 11).

11. Remove nuts and washers from right case side only.

12. Remove the case side (fig. 12).

13. Shaft assembly will now slide out of case.

14. <u>NOTE</u> - how the end canted disks are positioned in relation to each other (fig. 13).

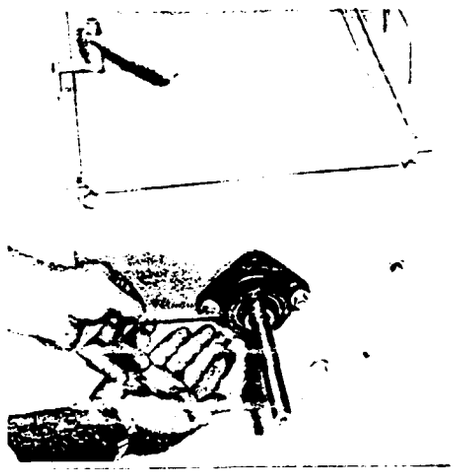


fig. 11

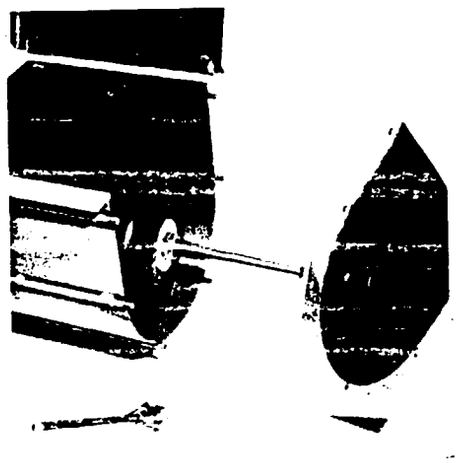
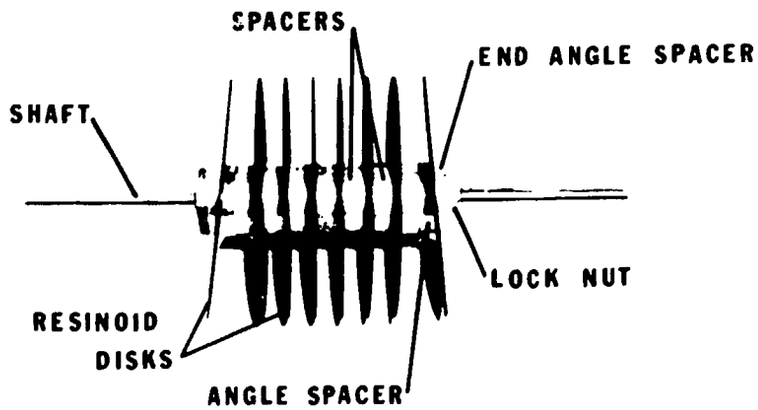


fig. 12



SHAFT ASSEMBLY

fig. 13

15. Remove large lock nut with spanner provided (fig. 13).

16. Slip end angle spacer off the shaft

17. Remove angled resinoid disk.

18. Slip angle spacer off and place with end angle spacer - KEEP TOGETHER.

19. Remove spacers and disks.

20. Replace old resinoid disks with new ones.

21. Reassemble shaft assembly.

22. Tighten large lock nut after the end canted disks are properly positioned. (fig. 13).

23. Reassemble in case with lock nut on right side.

24. Place case side on the two bottom threaded rods and replace washers and nuts (fig. 14). Do not tighten nuts.

25. Spring the ends till the remaining threaded rods engage in holes. Tap into place with fist (fig. 14) replace remaining washers and nuts and tighten.

26. Complete reassembly by working in reverse from step 10.

fig. 14

6.0 BALL-LOK CLUTCH

6.1 MECHANICAL FEATURES

The H.P. CAPACITY - of any BALL-LOK clutch is rated as equal to that of a pulley of the same size, when operated under normal recommended belt tension and loads. In general your regular pulley can be replaced with a clutch having the same pulley diameter.

ANTI-CORROSION FINISH - all BALL-LOK clutches are finished for corrosion resistance by cadmium plating of all parts.

BELTS - on a BALL-LOK clutch the belt itself is the only friction element. Longer belt life and less stretching can be expected because the belt is relaxed when not in use. The BALL-LOK design mechanically eliminates belt "grab" at the moment of engagement.

THERE IS NOTHING TO ADJUST - on a BALL-LOK clutch as it has no internal parts or friction elements. This feature eliminates the "parts" problem.

ENGAGING - a BALL-LOK clutch requires 1 to 3 seconds of constant pressure to engage. This time interval allows the belt to rise to the top of the pulley grove.

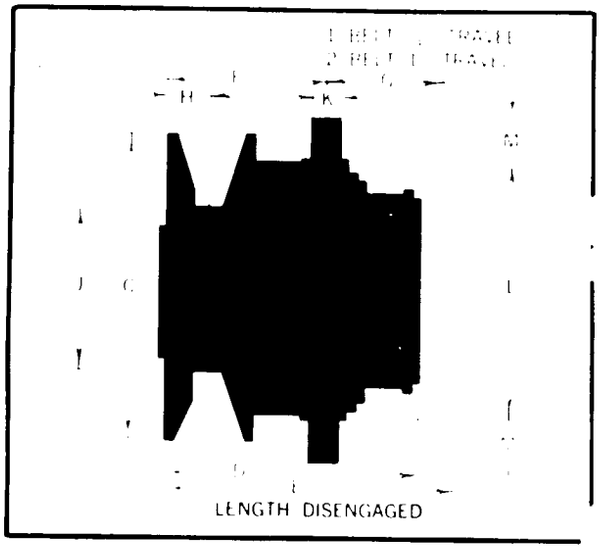
OPERATION - a BALL-LOK clutch can be activated by any mechanical means: fig.6, or by a remote control. It can be "slipped" when starting a heavy load. Constant pressure is not required to hold clutch engaged.

LUBRICATION - is needed to keep sliding parts in good condition. The use of a pressure hand gun with a quality lube such as Lubriplate is recommended. Most clutches are equipped with a pressure lubriction fitting.

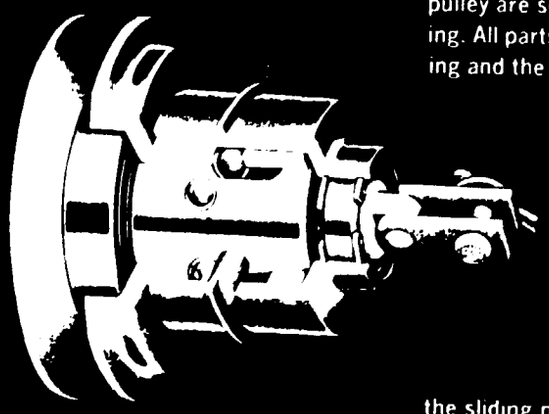
KEYWAYS AND SET SCREWS - are standard for the shaft size on most clutches. The set screw hole is about 1 1/2 inches (38 mm) from pulley end of clutch. (fig.9).

"ball-lok CLUTCHES R-SERIES

The all purpose low cost "R" Series clutch has a bronze throw out collar. This clutch comes complete with pulley, is easily installed, and offers a choice of shifter fork styles that best meets your installation requirements. Series R clutches are made for stub or through shafts. (For applications involving long idling periods, see Series "X.") CHARACTERISTICS: In the Series R clutch the disengaged belt rests on a self lubricating free running bronze idler bearing. Where design size permits, this idler may be a shielded ball bearing which is recommended for long or high-speed idling periods. Idler bearing options are shown in table. Series R clutches in the smaller sizes are low cost units for start and stop control of light gas engine drive. The larger sizes are especially useful in providing easy, slipping starts of heavy loads and obtaining unit control from line shafts. H.P. CAPACITY AND BELTS: Same as a pulley of the same size, if operated under normal tension. Use either "A" or "B" belt. "A" belt runs [illegible] lower in groove. See table. LUBRICATION: All clutches with bore sizes to 1" furnished standard with pressure grease fitting at no additional cost. SPECIFY BORE SIZE AND FORK STYLE WHEN ORDERING



FOR SHIFTING FORKS FOR THE "R" SERIES SEE PAGE 6



When the BALL-LOK clutch is disengaged, the flanges forming the pulley are separated so that the belt rides slack on the idler bearing. All parts of the clutch turn with the shaft except the idler bearing and the shifting mechanism. During engagement, the movable flange achieves the effect of a variable speed drive. Since the clutching action is the grip of the belt on the sides of the pulley, the pulley ratio changes as the belt rises to the top of the groove. As a result, the clutch action is surprisingly light and smooth, with grab and shock eliminated. The clutch locks itself against the balls in the closed position. The locking balls are carried forward by the sliding sleeve and drop into locking holes where they are held as the cam sleeve moves over them. The torque balls turn the sliding parts of the clutch and limit their travel. The Series SP sprocket clutch works on the same shifting and locking principle as the BALL-LOK clutch described above so that it starts and stops chain drives with similar positive ease.

INSTRUCTION SHEET - BALL-LOK CLUTCHES

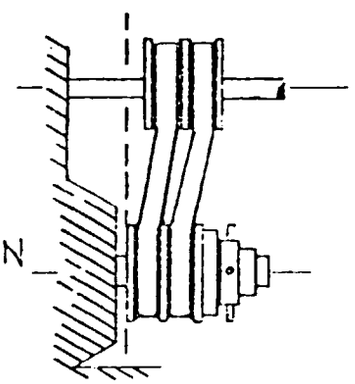
K-M Clutch Company
1420 SO. CAMPUS AVENUE, ONTARIO, CALIFORNIA 91762
PHONE: (714) 985-4569

PLEASE TRY OUR WAY FIRST
HOW TO INSTALL CLUTCH

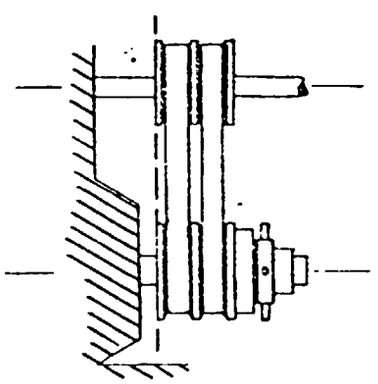
DO NOT DISASSEMBLE CLUTCH--it is not easy to assemble, and unnecessary for installation.
DO NOT DRIVE CLUTCH on to shaft. It has been carefully constructed to fit a clean shaft and good key.
CLUTCHES DESIGNED FOR STUB SHAFT SERIES X must not be mounted too far on shaft or sliding parts cannot completely close.
SET SCREW is exposed on 1-belt clutch by disengaging and rotating to expose access hole. TIGHTEN FIRMLY, and lightly STAKE TOP THREAD to prevent loosening, which would interfere with sliding action.
ADJUST BELT TO NORMAL TENSION WITH CLUTCH ENGAGED (pulley sides closed). If belt is too tight it may not close, or will require excessive pressure to engage. Clutch will not close on a dead belt. Clutch or belt must be turning BELTS, should be "IN LINE" when idling with opposite pulley, and slightly "OUT OF LINE" when engaged. This reduces tendency of belt to creep when disengaged. See Figs. 1 & 2.

ALLOW 1/8" 1 BELT
" 1/4" 2 "
" 5/16" 3 "
" 3/8 4 "

CLUTCHS SHOWN IN ENGAGED POSITION

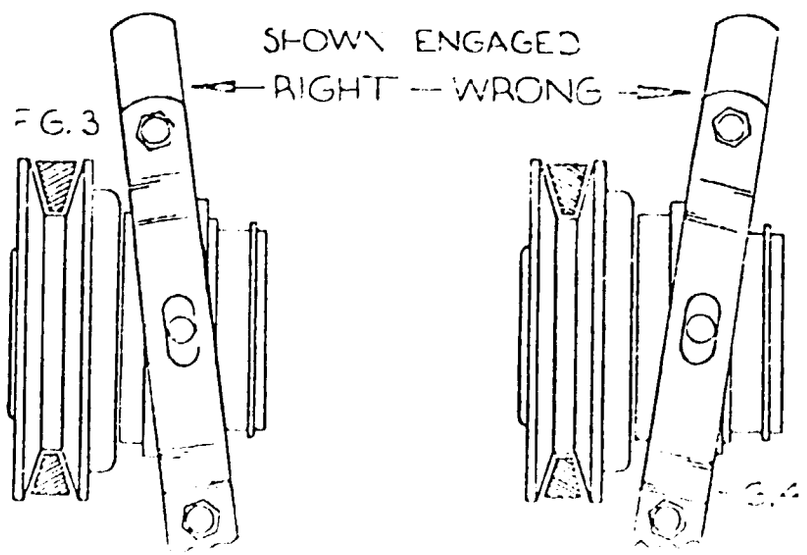


RIGHT
FIG. 1



WRONG
FIG. 2

HOW TO INSTALL LEVER OR SHIFTER FORK
IMPORTANT--Locate and drill a hole in the lever of Fork so that it pivots at about center of travel or swing, and moves OVER-CENTER when engaged or disengaged. This over-hanging weight restrains any tendency of clutch to jar open under extreme vibration or rough usage.
See Figs. 3 & 4.



TROUBLE SHOOTING THE BALL-LOK CLUTCH

IF CLUTCH WILL NOT STAY ENGAGED, or has a tendency to jar open: (1) The belts may be too tight, or set screw may be loose, and clutch is not locking properly, (2) Position of Shifter Fork or lever is incorrect and under vibration is pulling the clutch open. (See Figs. 3 & 4)

IF CLUTCH WILL NOT OPEN OR CLOSE after a period of service, the lock ball may have worn the Sliding disc or Hub. Use of round file in ball holes may correct this temporarily, but a new part should be ordered. Look for, and remove, any burrs that may have formed on the hub due to ball action.

IF CLUTCH RUNS HOT, bracket may have slipped causing the yoke, or collar to bind. The yoke or collar should be loose at all times and not under pressure. Belt may be too tight, or too loose, and is slipping. Avoid excessively tight belt. A larger pulley, or more belts may be needed to handle the load.

BRONZE IDLER BEARING after prolonged use may seize. Simple wash in kerosene or thinner to remove dust and dirt film carried in by belt. Do not oil idler bearing, it is self-lubricating.

OIL THE SLIDING PARTS ONLY. This will help prevent rust and keep them working freely. Periodic lubrication with pressure grease gun is recommended. On multi-belt models light oil on keyways is required to maintain sliding action.

ON R SERIES A REPLACEABLE BRONZE COLLAR, which is attached to the shifter fork is used to shift these clutches. When properly installed, the Collar WILL NOT BIND in the channel of the Cam sleeve (shifter ring) when Fork swings over-center. Collar must FLOAT in channel of Cam and be free of pressure, except when shifting the clutch.

DOUBLE END FORK

Match one short end to a long end, as in drawing below. This leaves long projections at each end, one of which is to be drilled near the end to engage the Pivot pin or bolt that will locate and support the FORK. To the other end add a short length, usually 8" to 12" of 1/8 steel, to provide a Handle for moving the Fork. See Fig. 5.

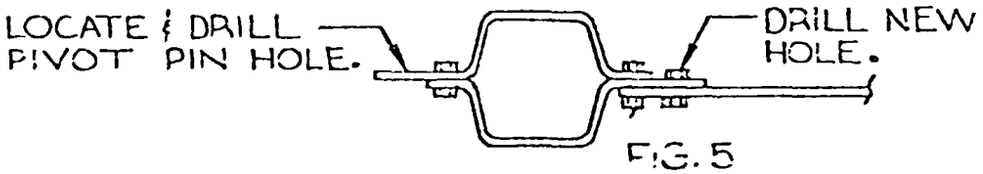
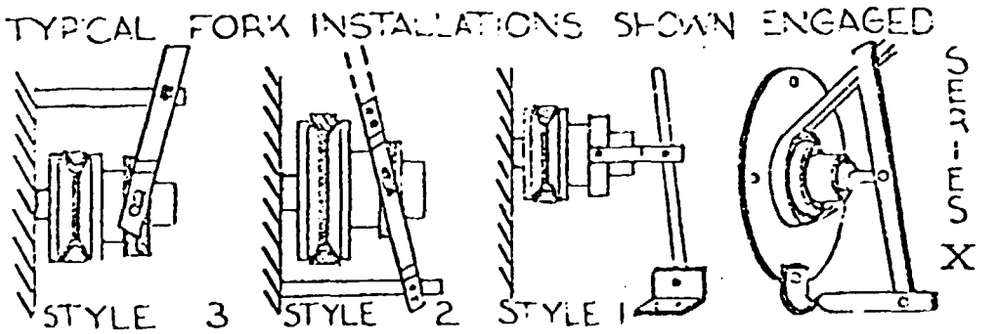


FIG. 5
DOUBLE END FORK ASSEMBLY



OFFSET FORK SEE FIG. 6

Some installations will require an offset fork design. Clamp Style 2 Fork in vice below or above trunnion holes. Strike firmly until desired angle is obtained. Offset design recommended when Style 2 Fork used on 5" or larger clutch.

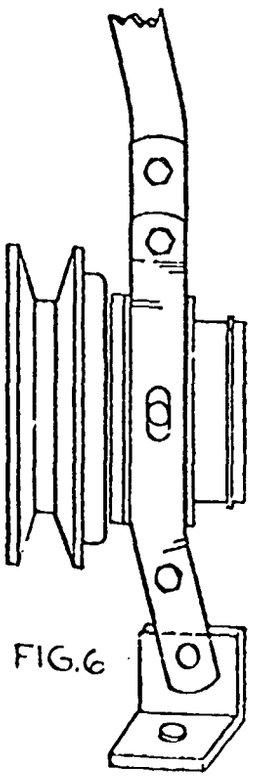


FIG. 6

7.0 PACKING LIST

1 - P.R.L. "MINI" DEHULLER with BALL-LOK clutch.

1 - instruction manual.

7.1 Tools

1 - adjustable wrench (spanner)

1 - 7/16 inch (36.5 mm) open end wrench (spanner)

2 - sets of Allen wrenches to fit all bearing collars and BALL-LOK clutch

1 - small hand lube gun

1 - container of quality lubricant

7.2 Spare Parts

1 - set of replacement nuts and bolts

1 - package of foam tape for gasket replacing

8 - Osborn A24S cut off disks, 10 inch (254 mm) O.D. x 1/8" (3.2 mm) thick x 1 inch (25.4 mm) hole

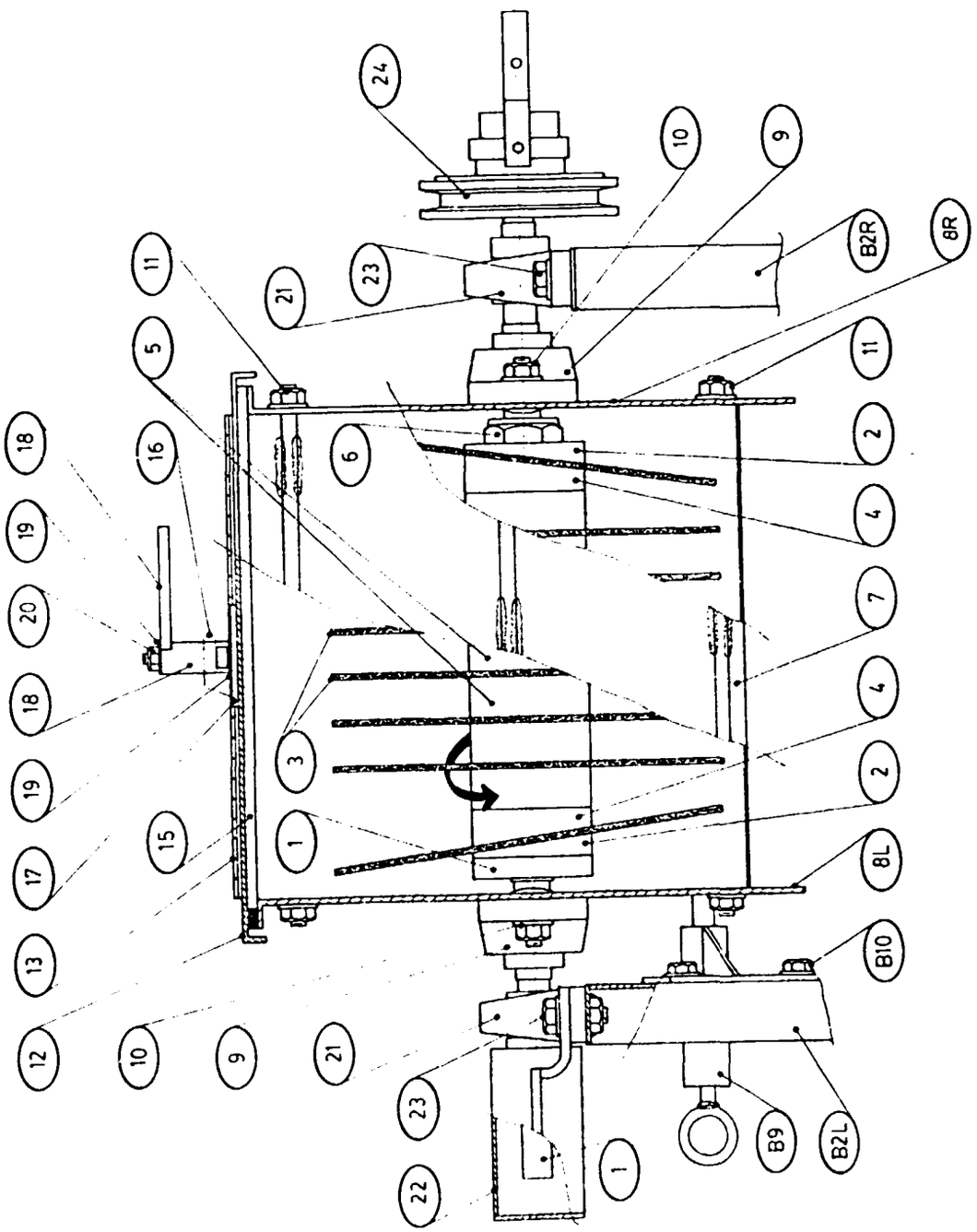
NOTE

OSBORN A24S cut-off disks can be obtained from:

Abrasive Specialties Ltd.
17 London Road
Ascot, Berkshire
England

PART NO	PART NAME	NO. REQ.
1	Shaft	1
2	End angle spacer	2
3	OSBORNE 10"A24 : cut off disks	8
4	Angle spacer	2
5	Spacer	7
6	1"-14 Lock nut	1
7	Case body	1
8L	Left case end plate	1
8R	Right case end plate	1
9	Flanged, self aligning bearing FAFNIR RAK - 7/8"	2
10	3/8"-16 x 1" carrage bolts, washers & nuts	4
11	3/8"-16 nuts & washers	12
12	Hinged top	1
13	Steel piano hinge - 12" long	1
14	Hinged top stop	1
15	Gasket - foam type	1
16	Latch	1
17	Latch handel base	1
18	Latch handel	1
19	3/8" washer	2
20	3/8"-16 Lock nut	1
21	Pillow block self-aligning bearing FAFNIR RAK 13/16"	2 2
22	Shaft guard	1
23	3/8"-16 x 1 1/4" bolts & washers	4
24	XBS BALL-LOK clutch for 3/4" shaft & shifter fork	1
B1L	Channel base - left	1
B1R	Channel base - right	1
B2L	Bearing frame - left	1
B2R	Bearing frame - right	1
B3	Motor base	1
B4	Chute bottom	1
B5	Chute side	2
B6	Chute edge	2
B7	Angle iron spreader, 11/2" x 11/2" x 1/8" x 16 1/2"	1
B8	3/8"-16 x 1 1/4" bolts & washers	4
B9	Locking pin & bracket	1
B10	3/8"-16 x 1" bolts & washers	2
S1	Stand side	2
S2	Stand spreader	2
S3	3/8"-16 x 1" bolts & washers	8

(24) — NOTE "BALL-LOK" clutch necessary if powered by gas engine


24
10
9
B2R
8R
11
23
21
5
11
2
6
16
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18
4
19
3
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15
1
8L
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B10
12
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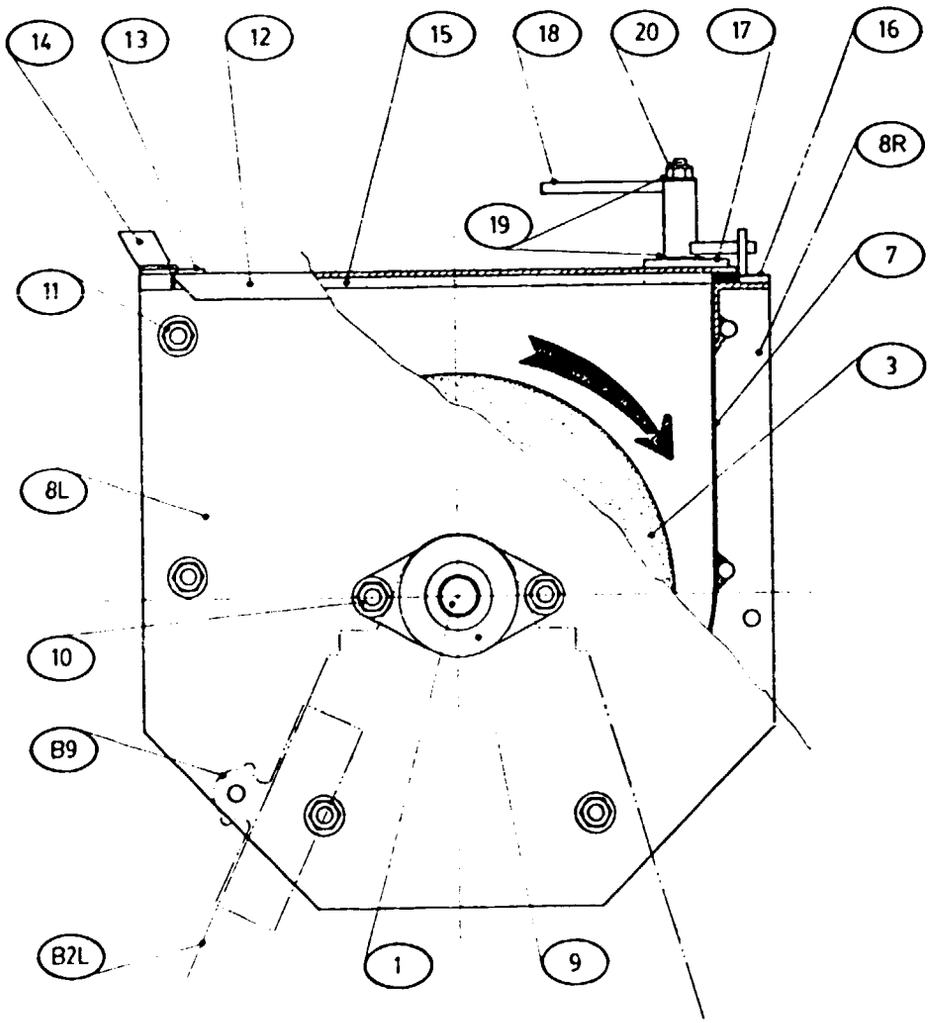
21
23
B9
B2L
22
1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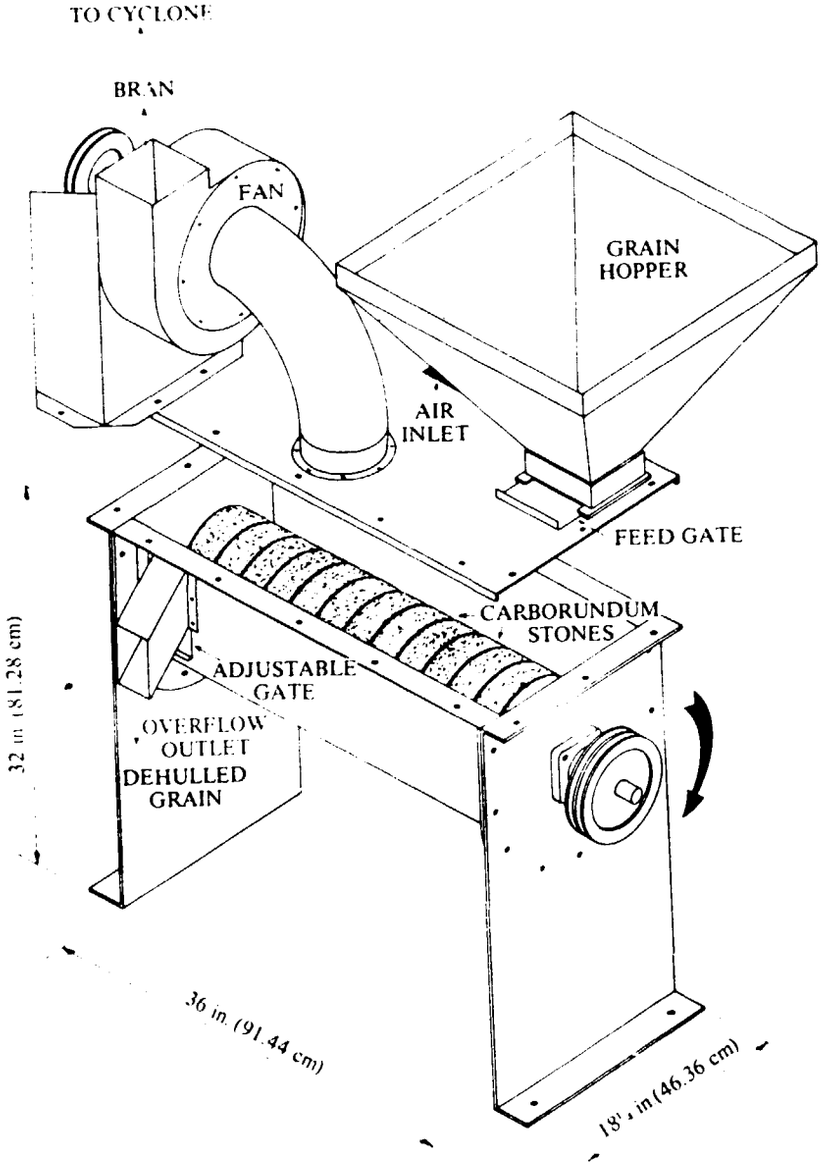
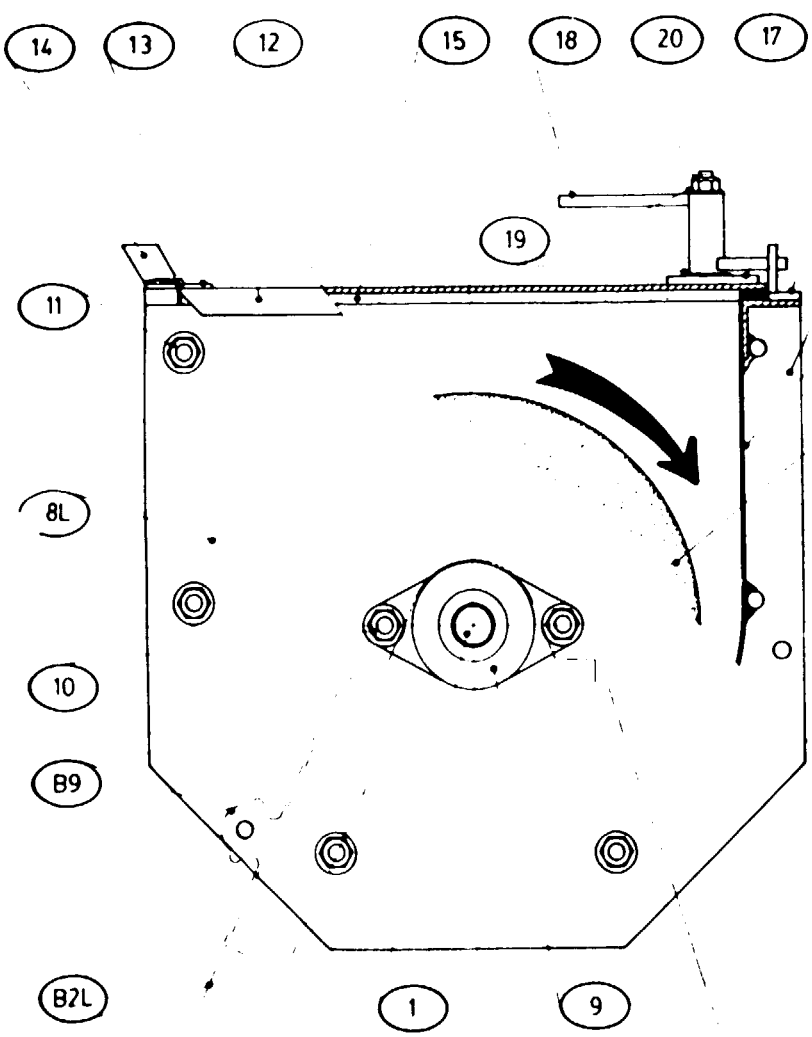


Fig. 2 The PRL dehuller is identical to the PRL/ RHC dehuller except that the latter has a hinged door on the bottom to let any residual dehulled cereal drop into a collecting basin.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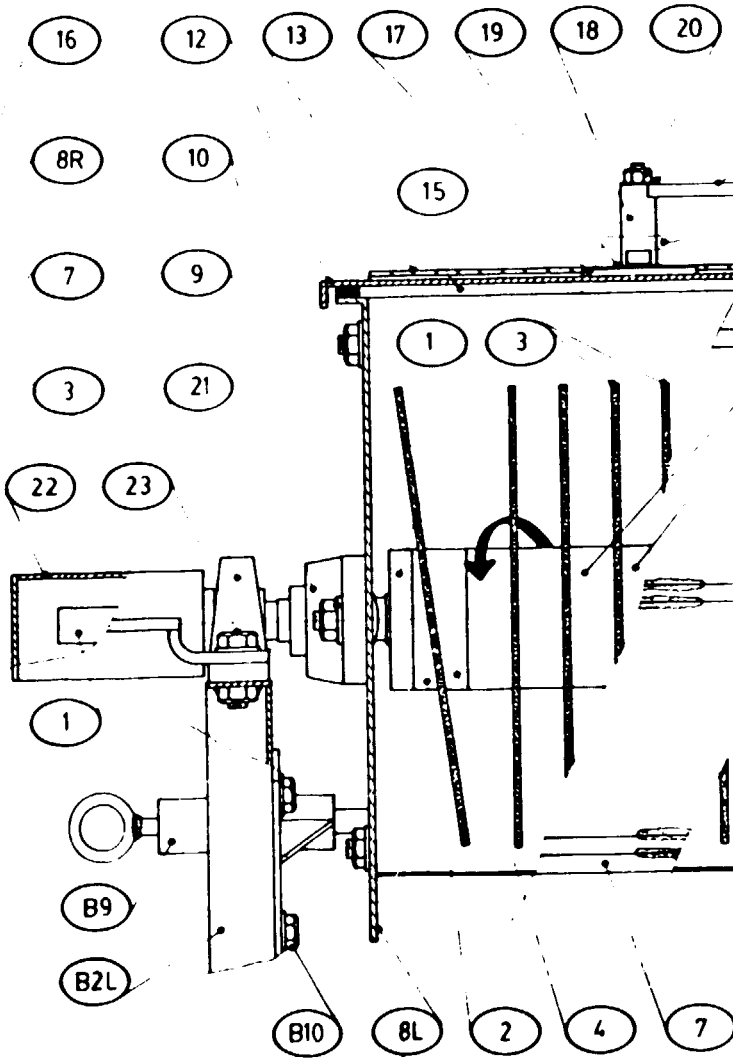
16
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3
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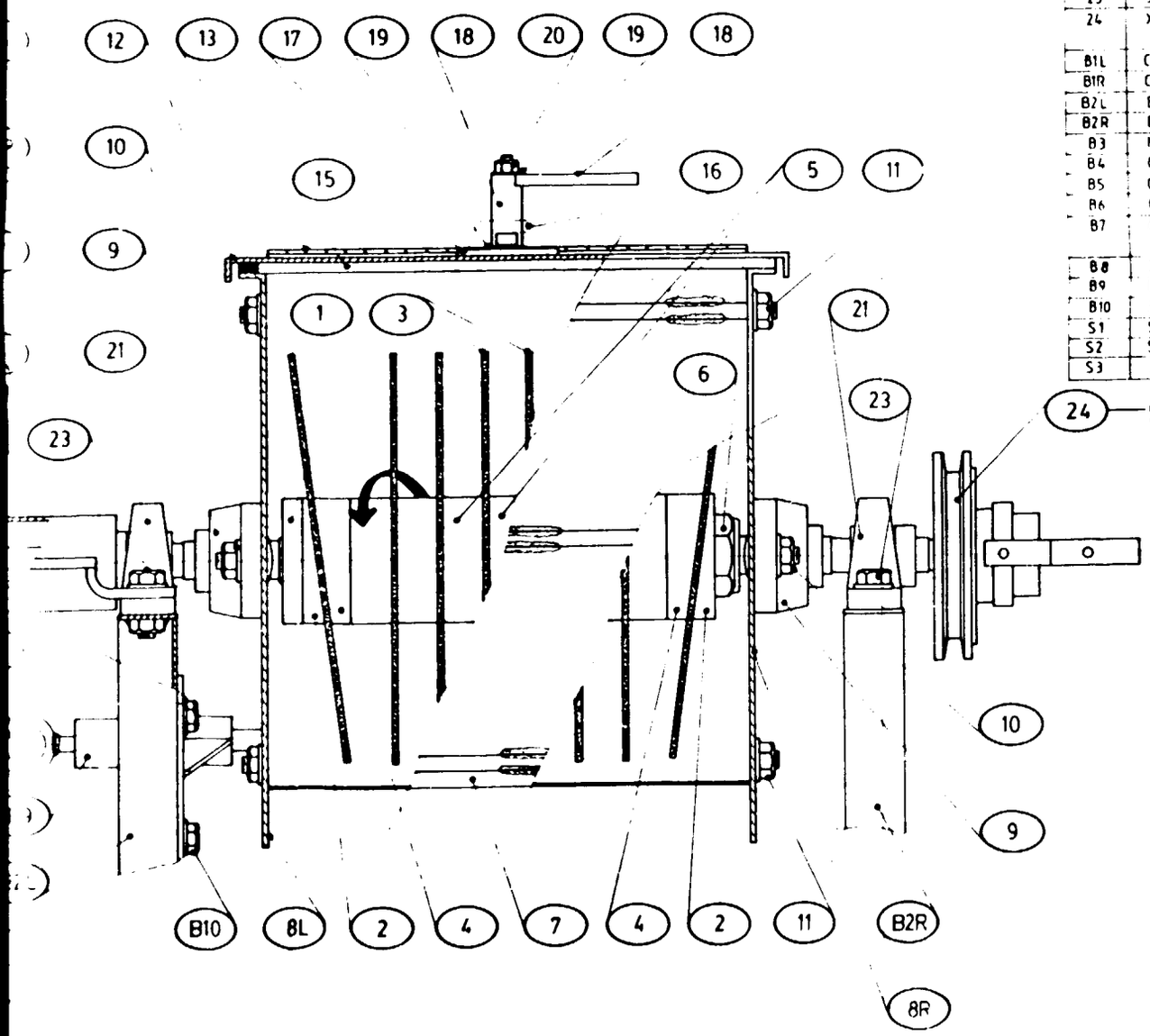
21
22
23
1
B9
B2L
B10
8L
2
4
7

SECTION 1

PART NO	PART NAME	NO REQ
1	Shaft	1
2	End angle spacer	2
3	OSBORNE 10" A245 cut off disks	A
4	Angle spacer	2
5	Spacer	7
6	1"-14 Lock nut	1
7	Case body	1
8L	Left case end plate	1
8R	Right case end plate	1
9	Flanged self aligning bearing FAFNIR RAK - 7/8"	2
10	3/8 - 16 x 1" carrage bolts, washers & nuts	4
11	3/8"-16 nuts & washers	12
12	Hinged top	1
13	Steel piano hinge - 12" long	1
14	Hinged top stop	1
15	Gasket - foam type	1
16	Latch	1
17	Latch handel base	1
18	Latch handel	1
19	3/8" washer	2
20	3/8"-16 lock nut	1
21	Pillow block self aligning bearing	2
	FAFNIR RAK 13/16	2
22	Shaft guard	1
23	3/8"-16 x 1 1/4" bolts & washers	4
24	XBS BALL-LOK clutch for 3/4 shaft & shifter fork	1
B1L	Channel base - left	1
B1R	Channel base - right	1
B2L	Bearing frame - left	1
B2R	Bearing frame - right	1
B3	Motor base	1
B4	Chute bottom	1
B5	Chute side	2
B6	Chute edge	2
B7	Angle iron spreader 1 1/2 x 1 1/2 x 1/8" x 16 1/2"	1
B8	3/8"-16 x 1 1/4" bolts & washers	4
B9	Locking pin & bracket	1
B10	3/8"-16 x 1" bolts & washers	4
S1	Stand side	1
S2	Stand spreader	2
S3	3/8"-16 x 1" bolts & washers	A

NOTE BALL-LOK clutch necessary if powered by gas engine



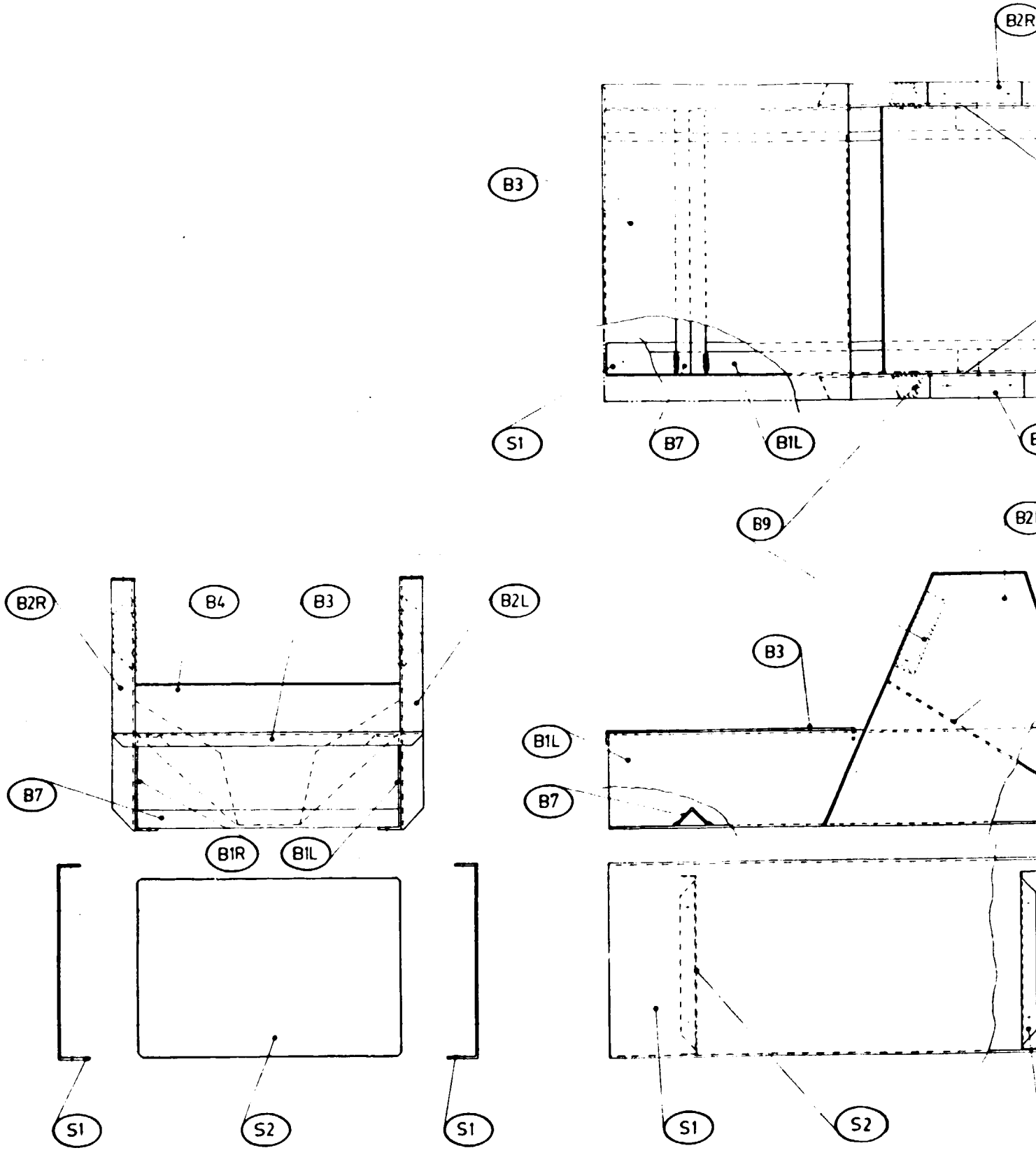
10x12 GRAIN DEHULLER

Sheet 1 of 7

1/4 1 Revised

A F r

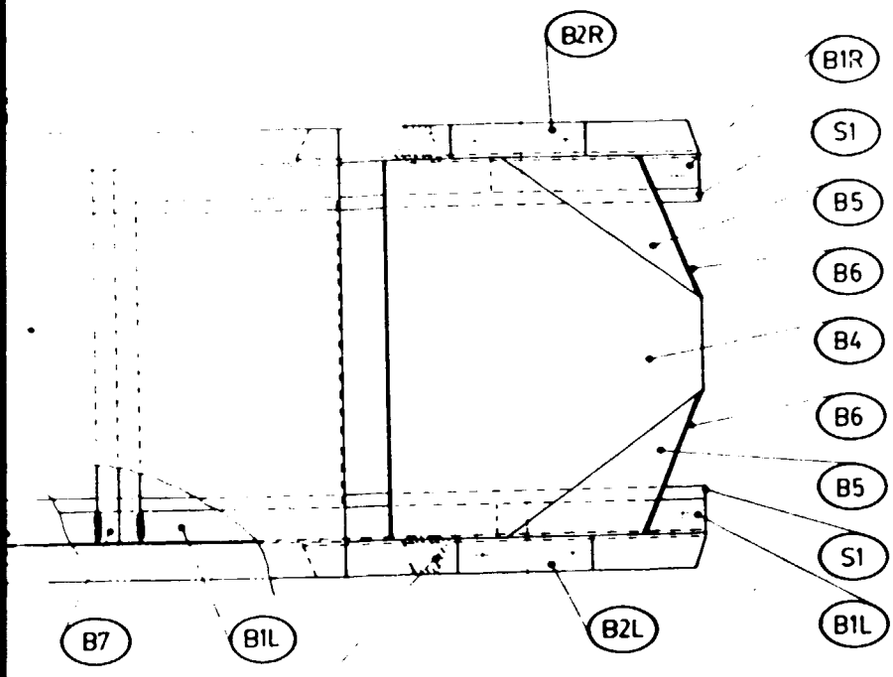
SECTION 2



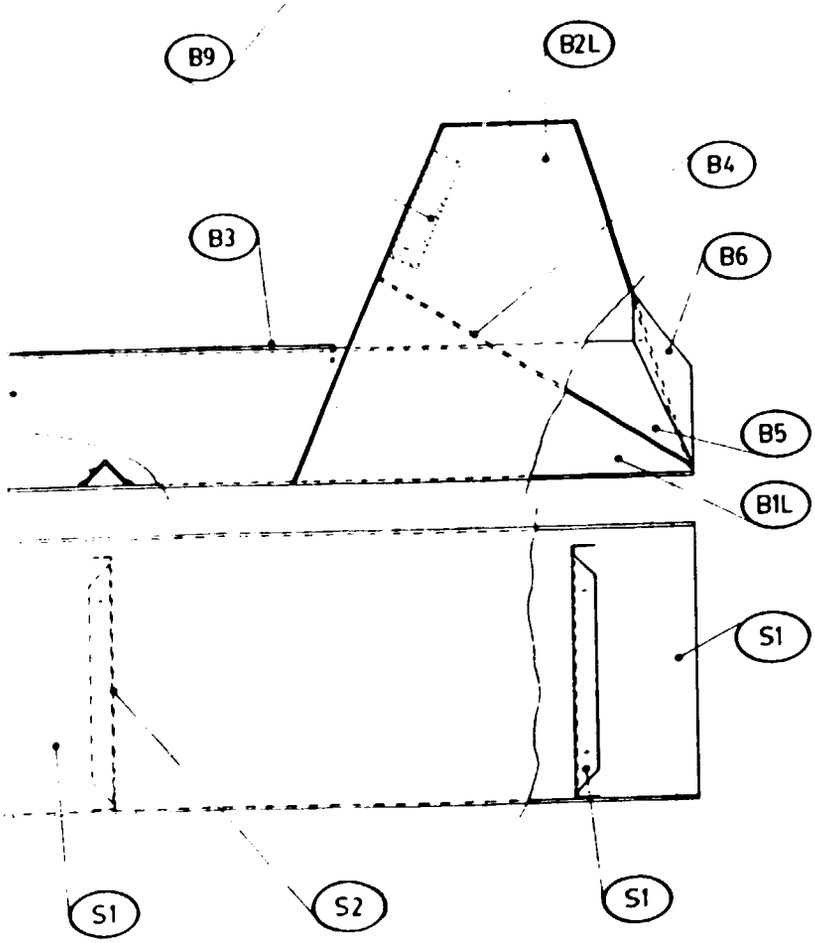
REAR VIEW

LEFT SIDE VIEW

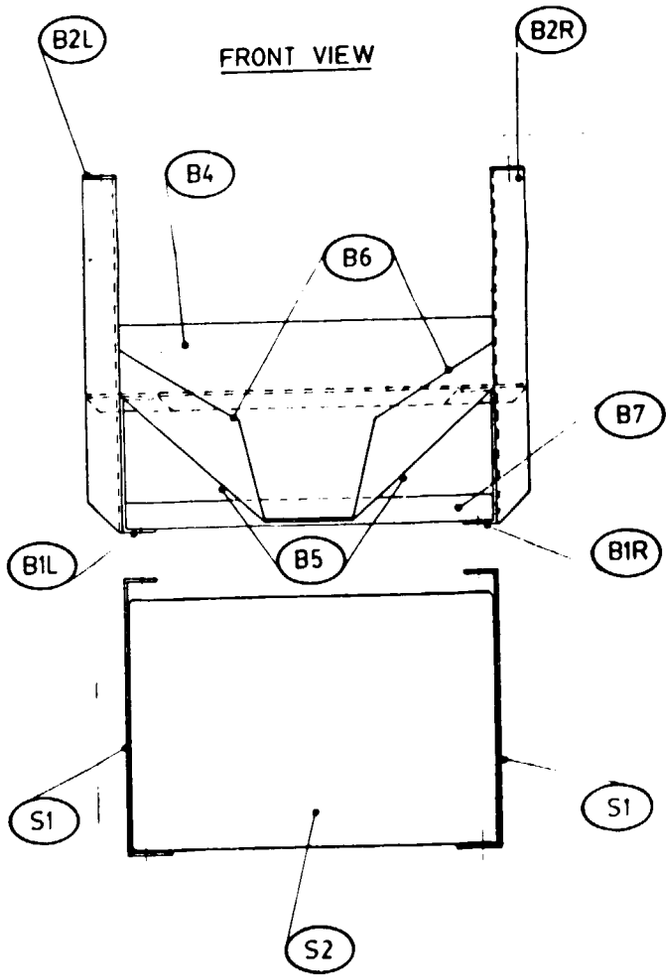
SECTION 1



NOTE
The following parts are welded together, to form a solid base
B1L, B1R, B2L, B2R, B3, B4, B5, B6, B7

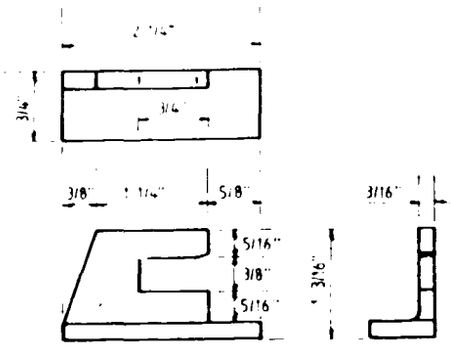


LEFT SIDE VIEW



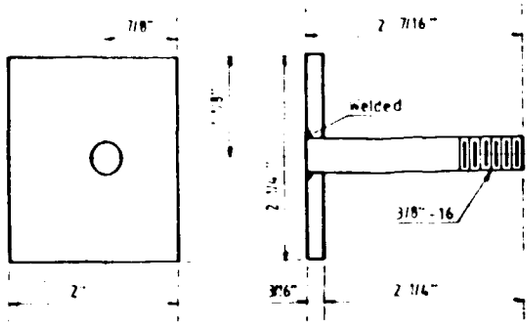
SECTION 2

10x12 GRAIN DEHULLER
Sheet 2 of 7
1/4"= 1"
Revised
AEY



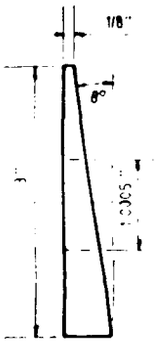
(16) LATCH

Mat Cut from 3/16" angle iron
1 Req



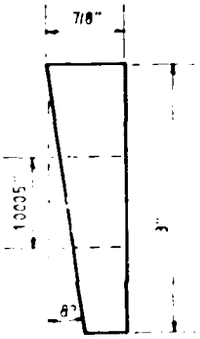
(17) LATCH HANDLE BASE

Mat Steel
1 Req



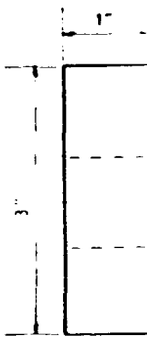
(2) END ANGLE SPACER

Mat Al
2 Req



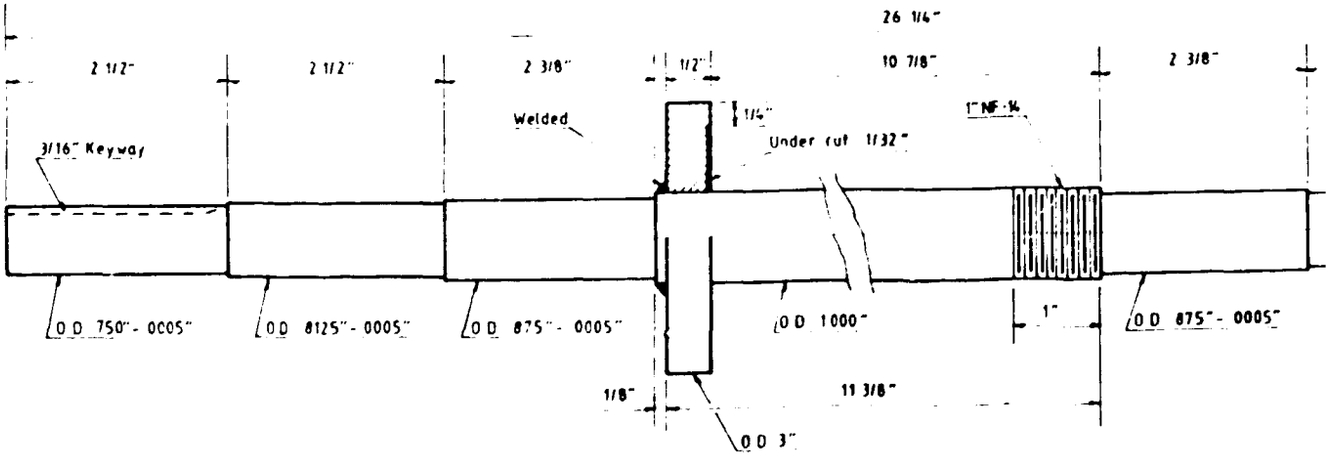
(4) ANGLE SPACER

Mat Al
2 Req



(5) SPACER

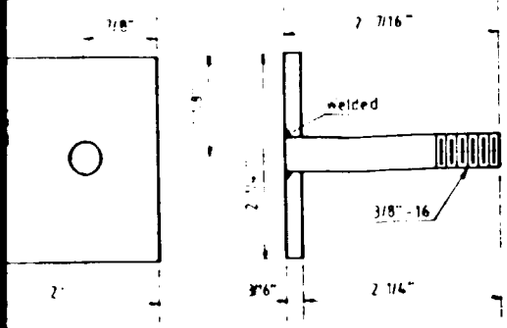
Mat Al
7 Req



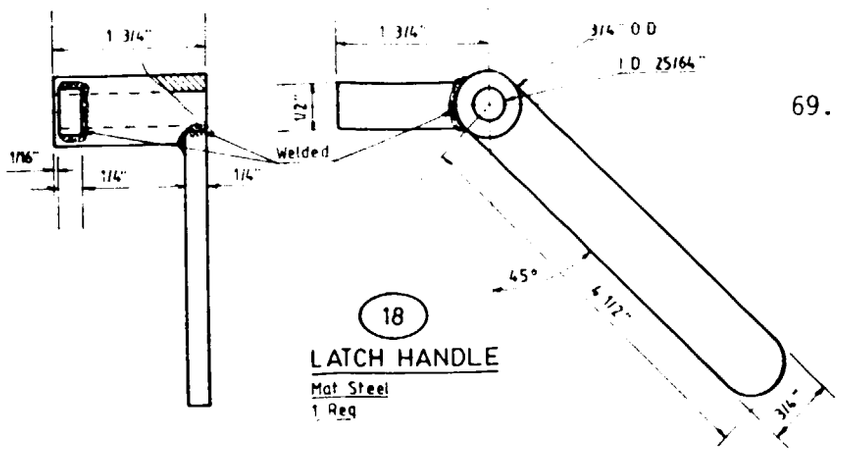
(1) SHAFT

Mat Steel
1 Req

SECTION 1

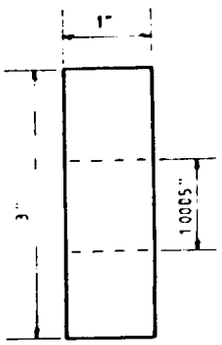


(17) LATCH HANDLE BASE
Mat Steel
1 Req

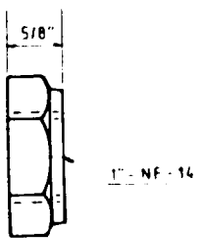


(18) LATCH HANDLE
Mat Steel
1 Req

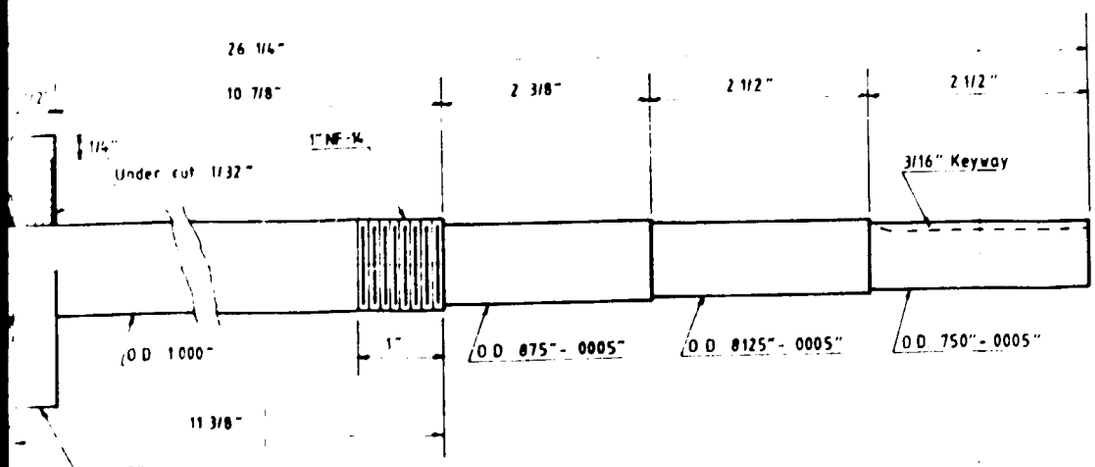
'ACER



(5) SPACER
Mat Al
7 Req

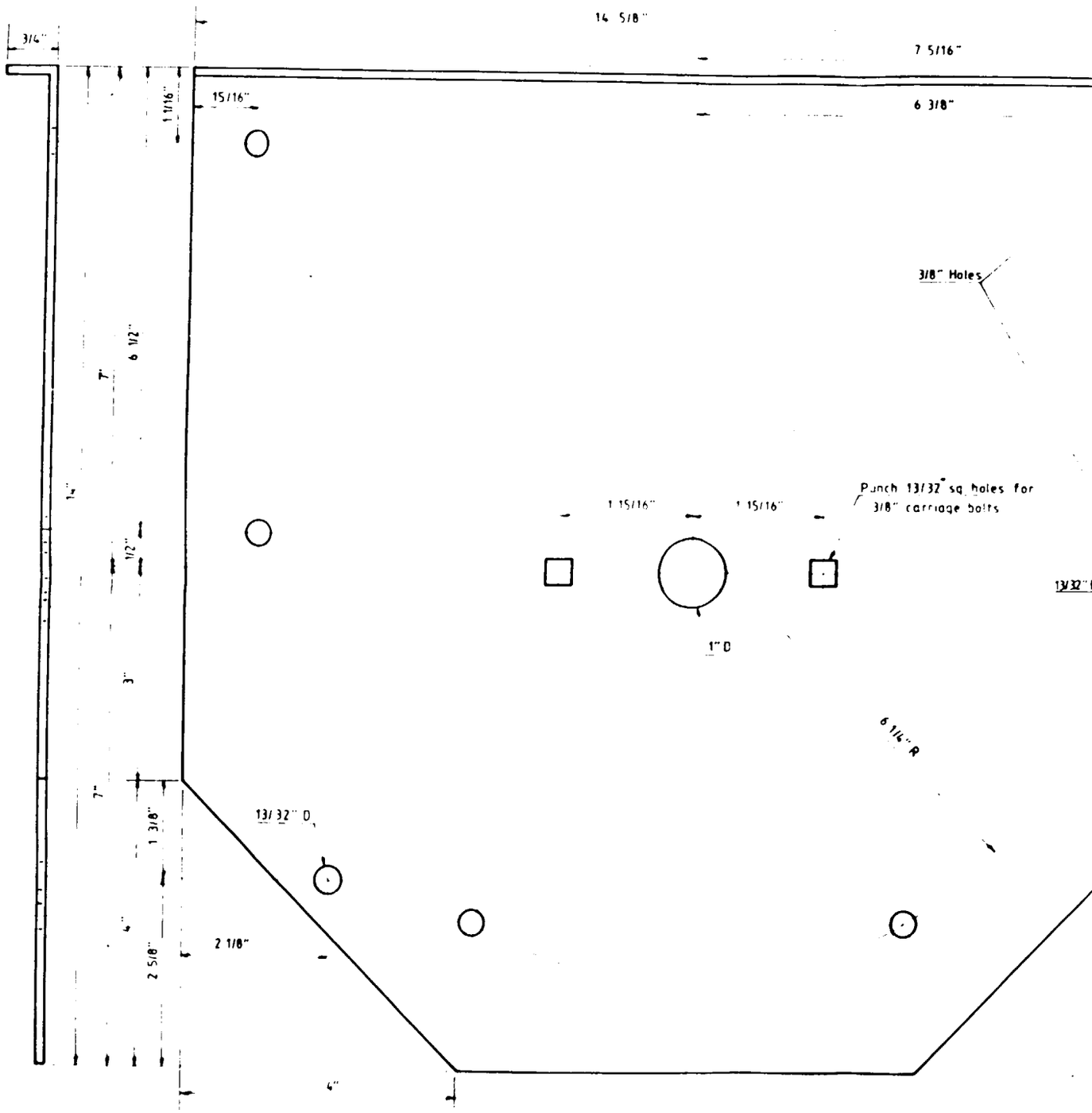


(6) LOCK NUT
Mat Steel
1 Req



SECTION 2

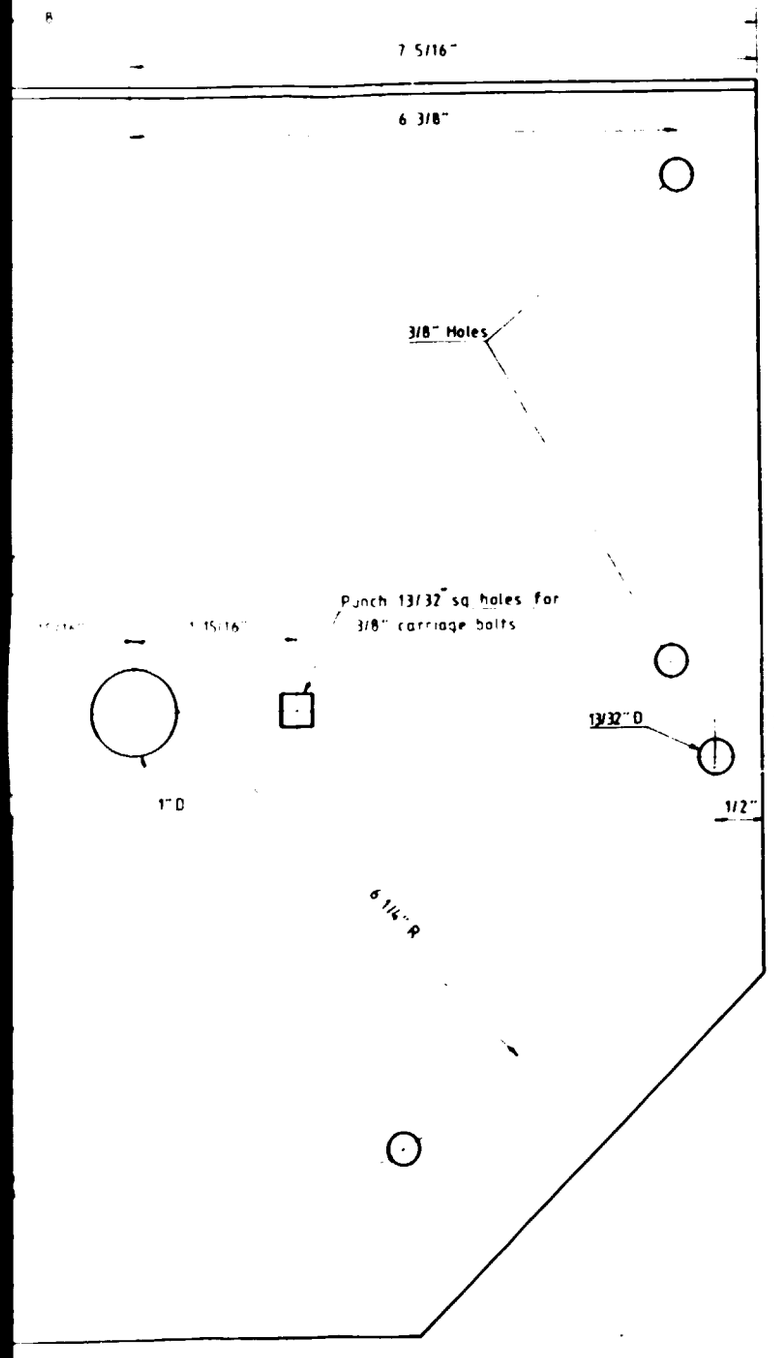
10x12 GRAIN DEHULLER
Sheet 3 of 7
Revised



(8L) END PLATE

Mat 10 body steel
2 Req one LEFT & one RIGHT
Scale 1" = 1"

SECTION 1

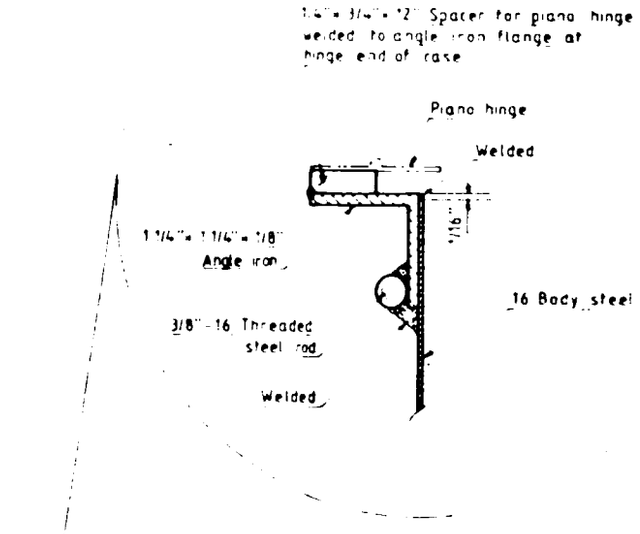


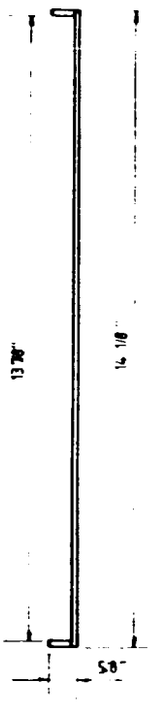
NOTE
End plate for left side of case shown. 3/4" flange should be bent to right for right side of case

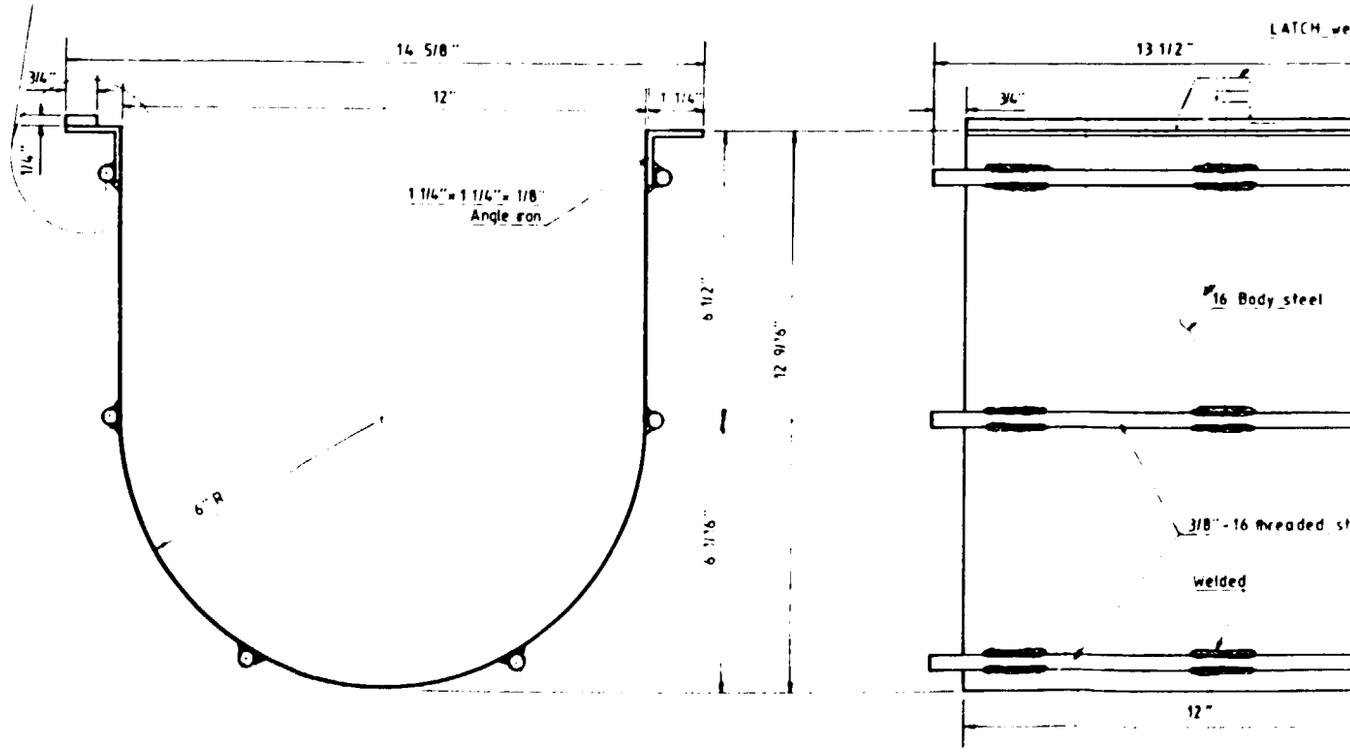
(8L) **END PLATE**
Mat 10 body steel
2 Req one LEFT & one RIGHT
Scale 1" = 1"

SECTION 2

10x12 GRAIN DEHULLER
Sheet 4 of 7
1/2 : 1" Revised
A F Y

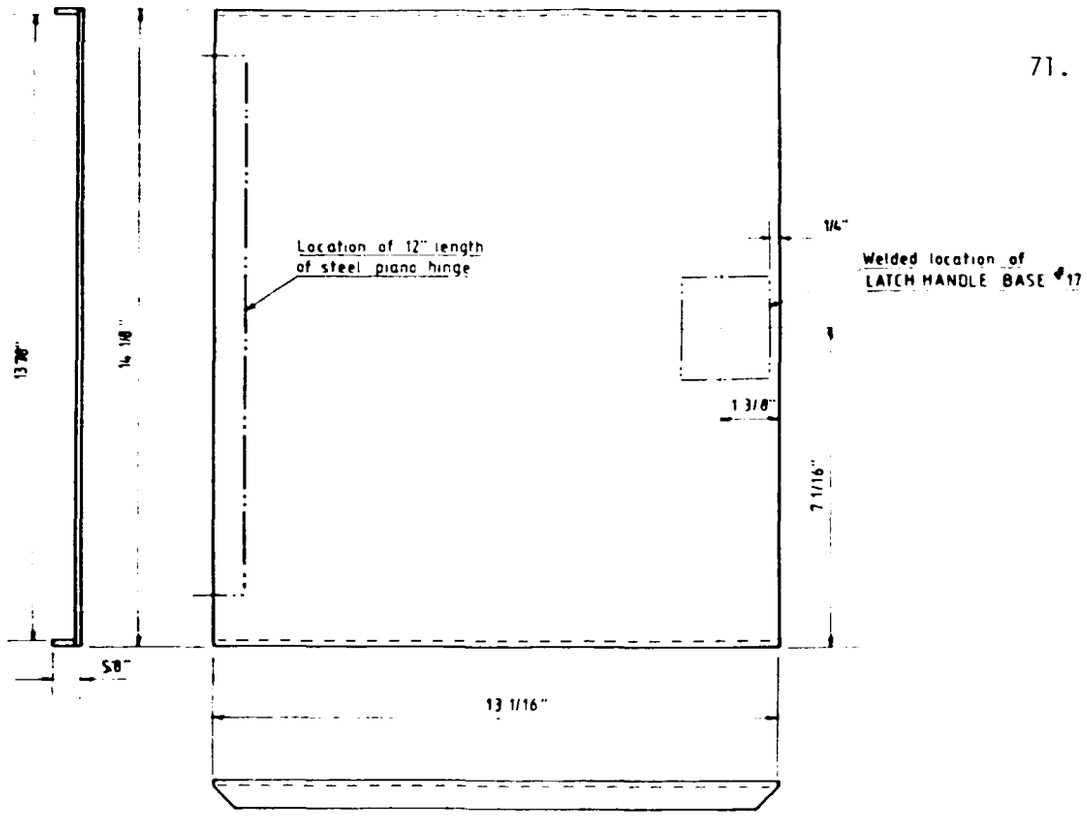






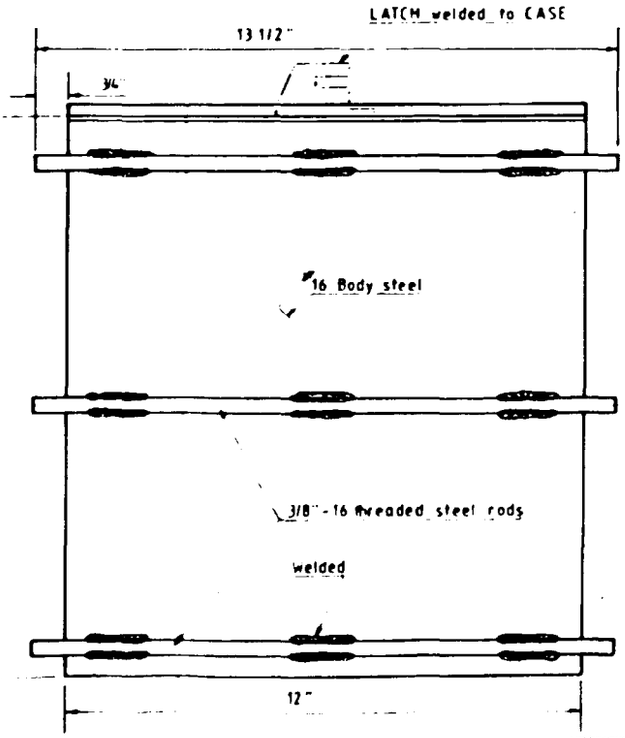
SECTION 1

7 CASE
Mat' steel
1 Req



(12) **HINGED TOP**

Mat 10 body steel
1 Req

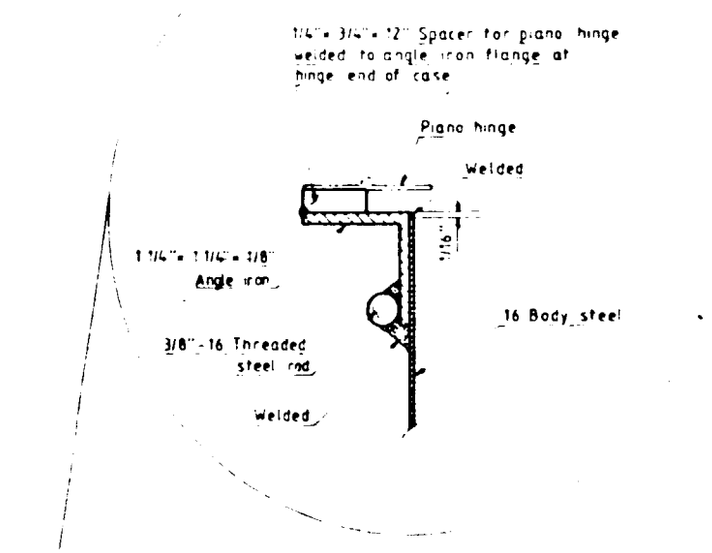


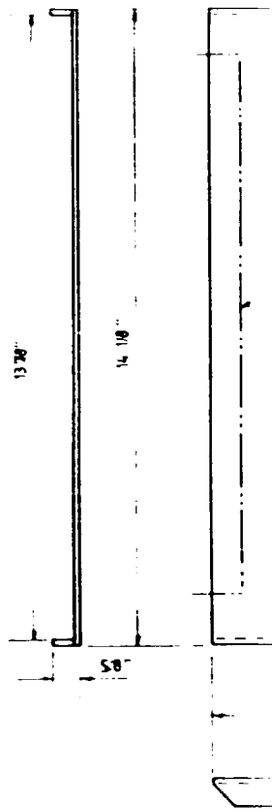
NOTE
Before welding threaded rods to case, assemble ends, case and align, using threaded rods to clamp together. Then weld rods to case

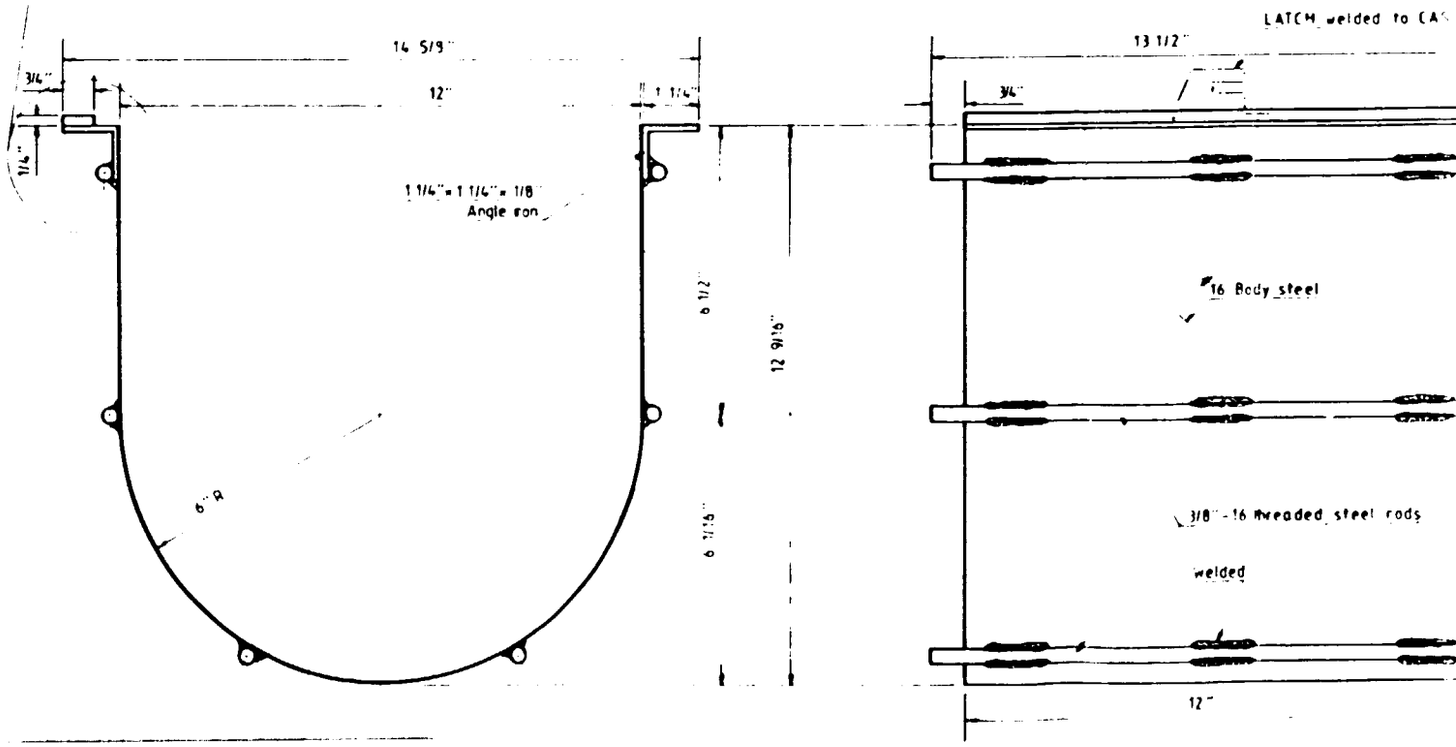
CASE
steel
req

SECTION 2

10x12 GRAIN DEHULLER
Sheet 5 of 7
1/4" = 1" Revised
AEY

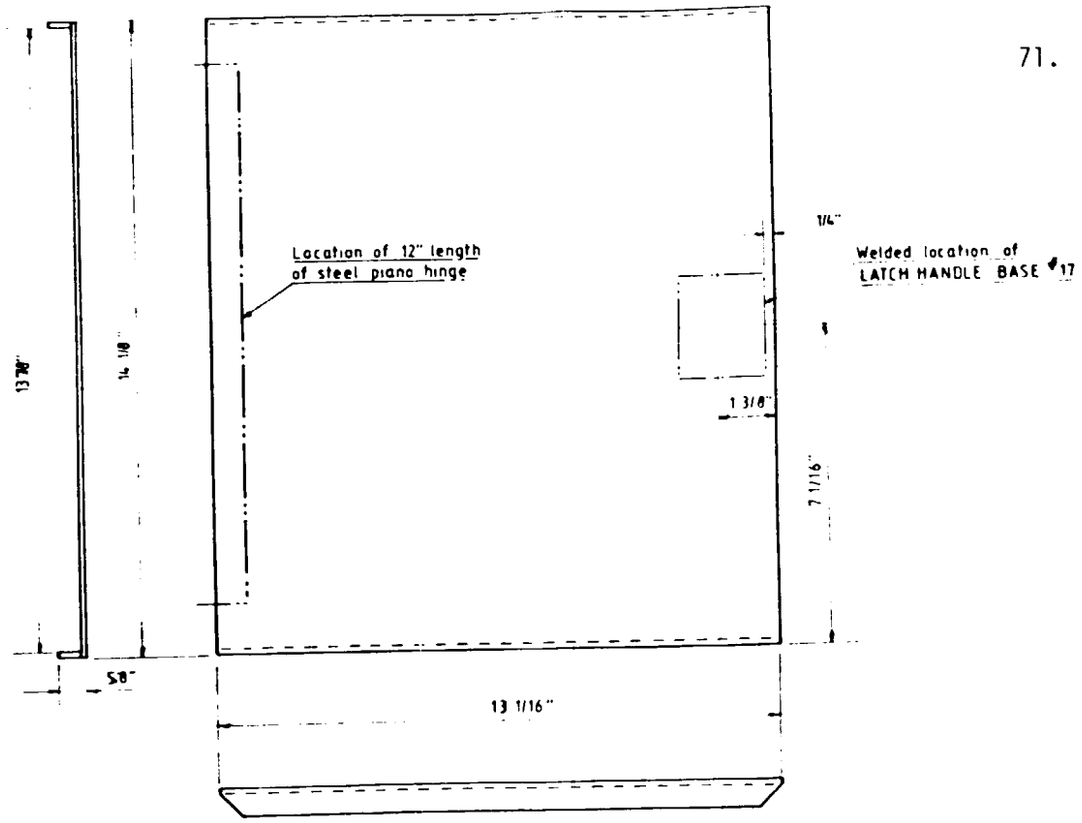






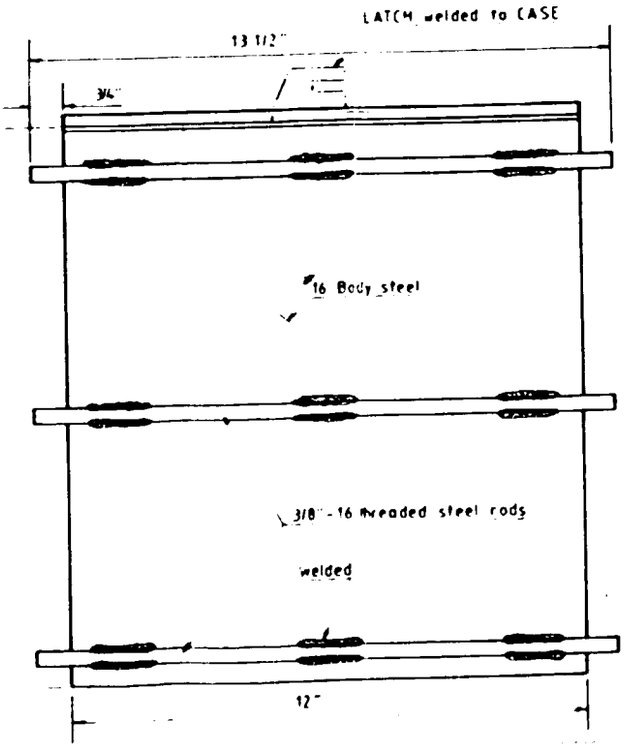
SECTION 1

(7) CASE
MG steel
1 Req



(12) **HINGED TOP**

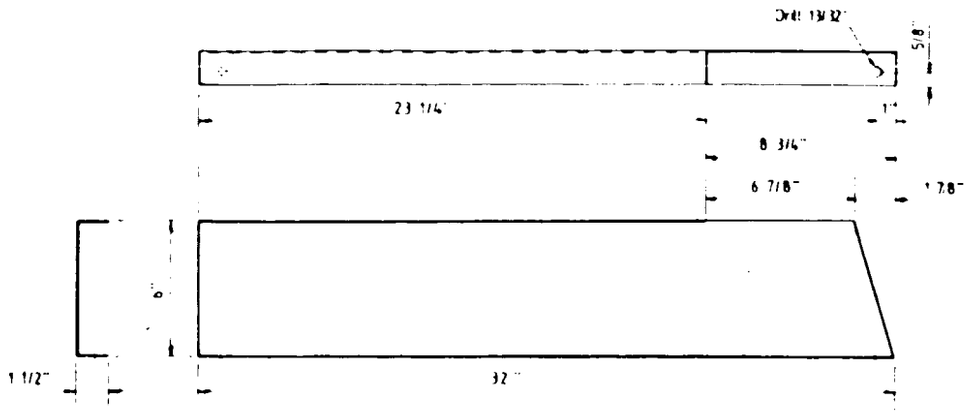
Mat 10 body steel
1 Req



NOTE
Before welding threaded rods to case, assemble ends, case and align, using threaded rods to clamp together. Then weld rods to case

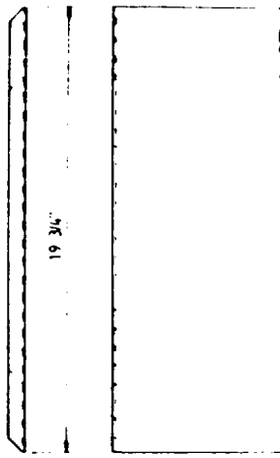
SECTION 2

10x12 GRAIN DEHULLER
Sheet 5 of 7
1/4" = 1" Revised
A.F.Y.



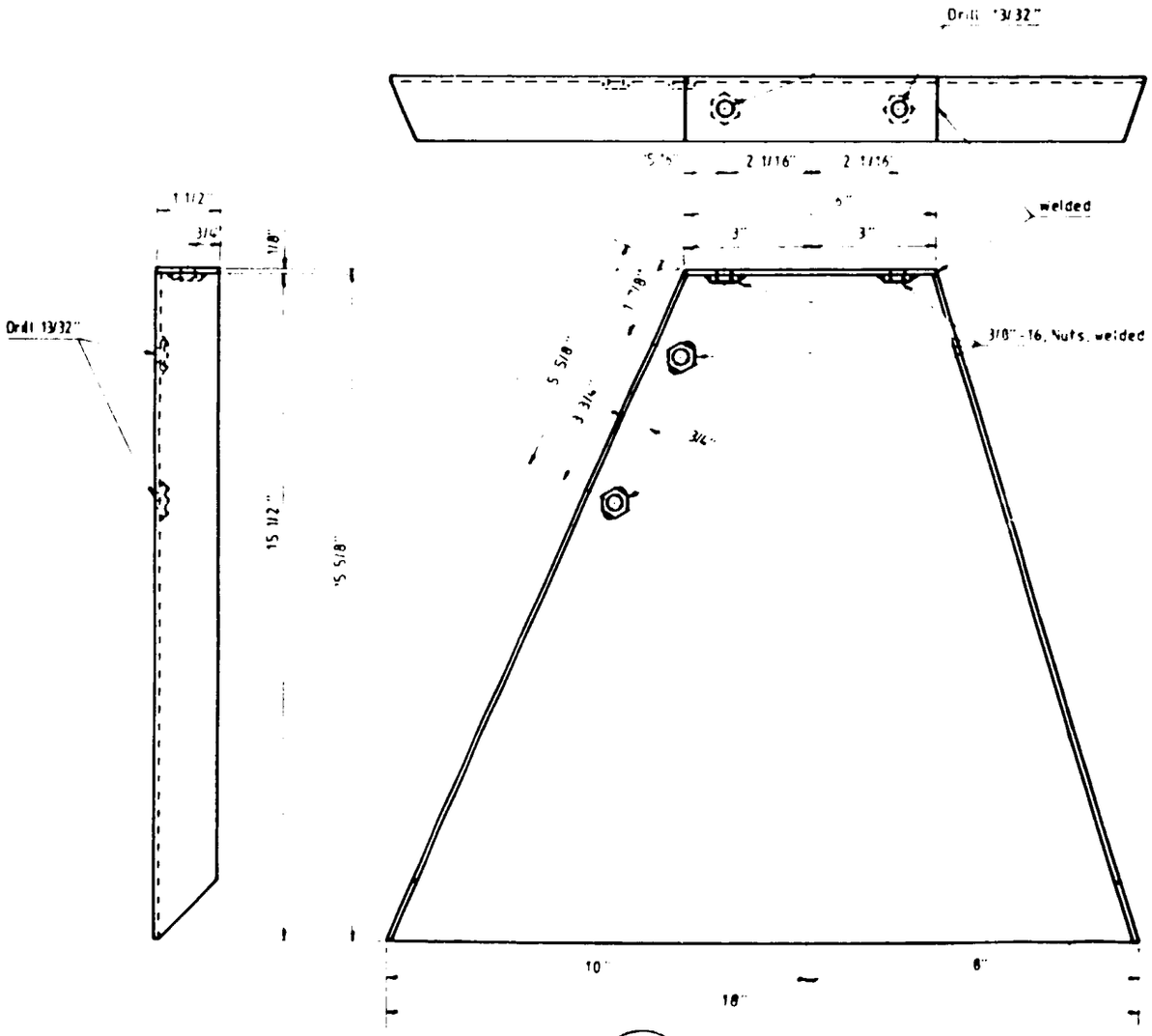
B1R **CHANNEL BASE**

Mat # 10 body steel
2 Req. one LEFT & one RIGHT
Scale 3" = 1'-0"



B3 MO1

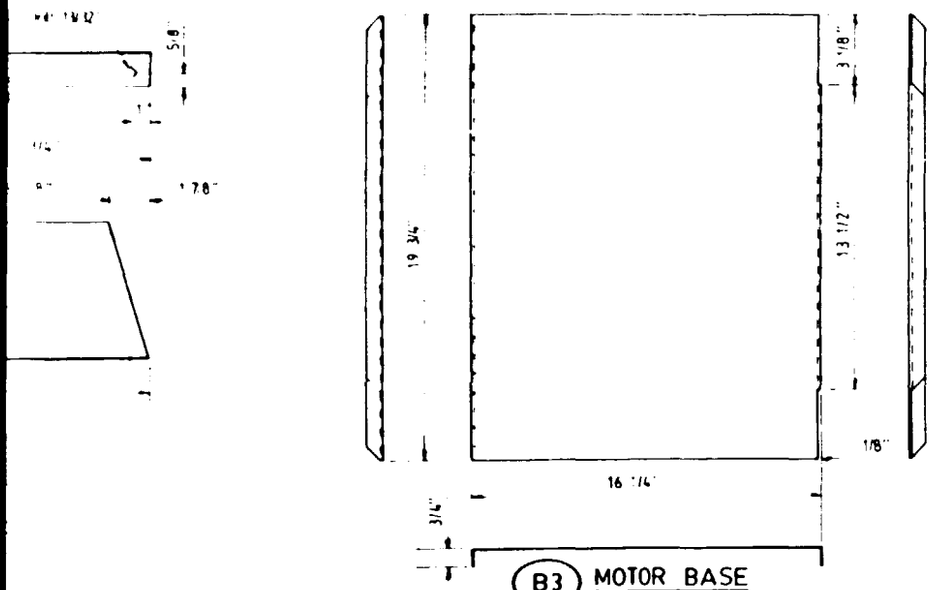
Mat
1 R
Sca



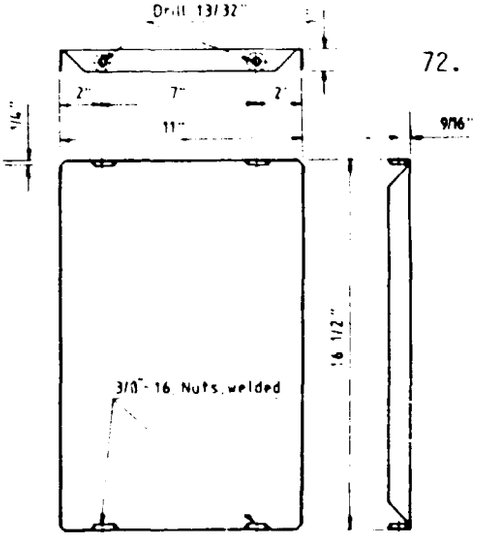
B2L **BEARING FRAME**

Mat # C body steel
2 Req. one LEFT & one RIGHT
Scale 6" = 1' 0

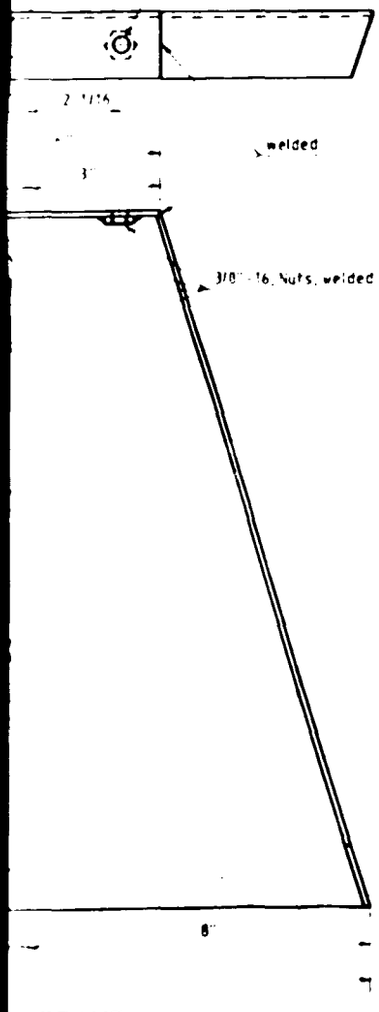
SECTION 1



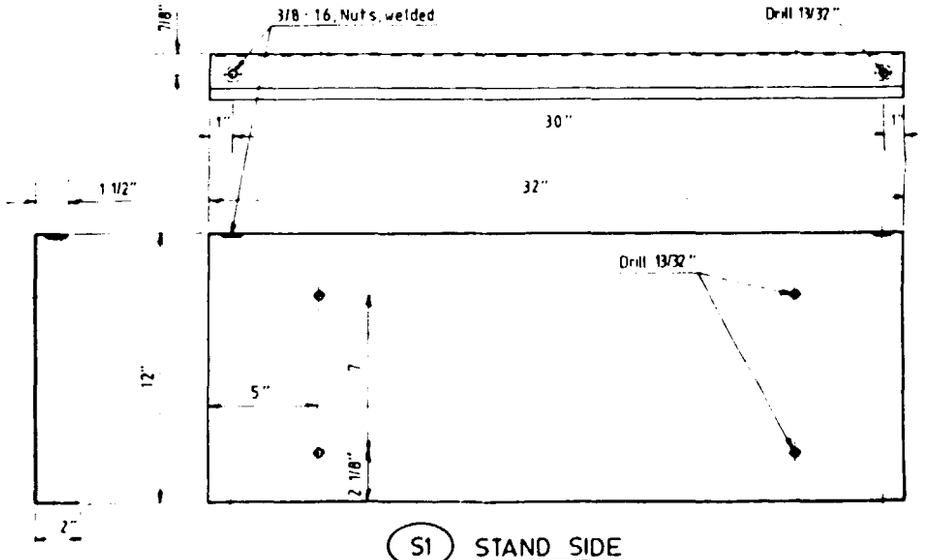
B3 MOTOR BASE
Mat #10 body steel
1 Req
Scale 3"=1'-0"



S2 STAND SPREADER
Mat #16 body steel
2 Req
Scale 3"=1'-0"



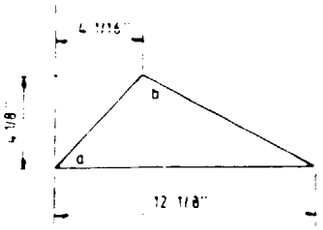
FRAME
1 Req'd
LEFT & one RIGHT



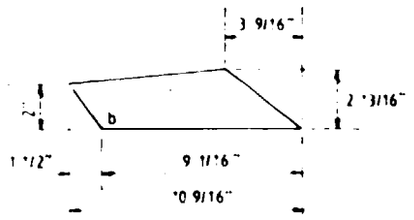
S1 STAND SIDE
Mat #10 body steel
2 Req
Scale 3"=1'-0"

SECTION 2

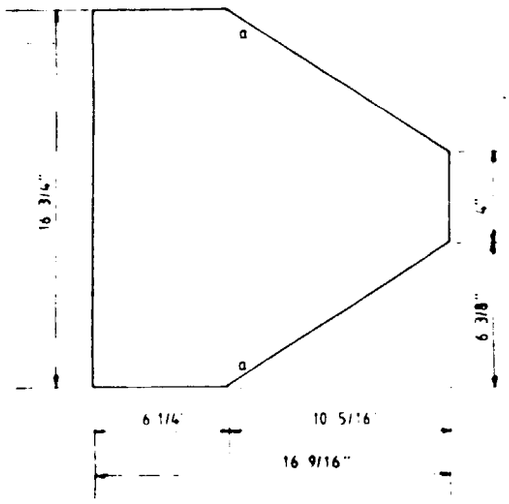
10x12 GRAIN DEHULLER
Sheet 6 of 7
1/2" = 1" Revised
A.E.Y.



B5 CHUTE SIDE
2 Req

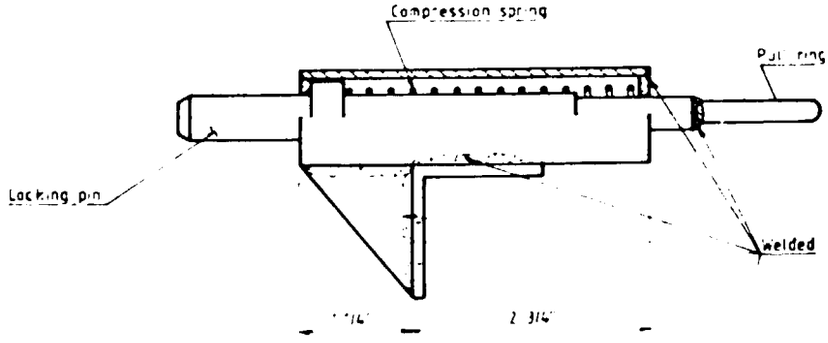


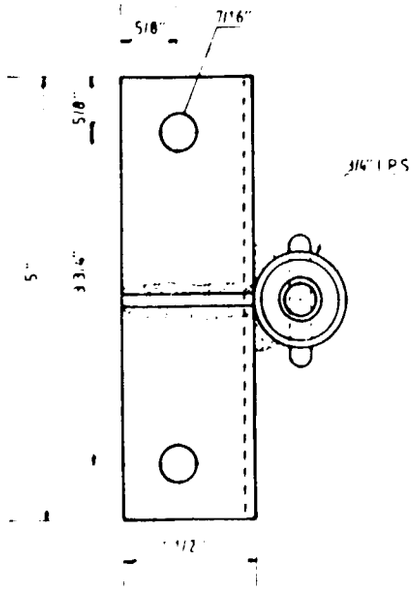
B6 CHUTE EDGE
2 Req

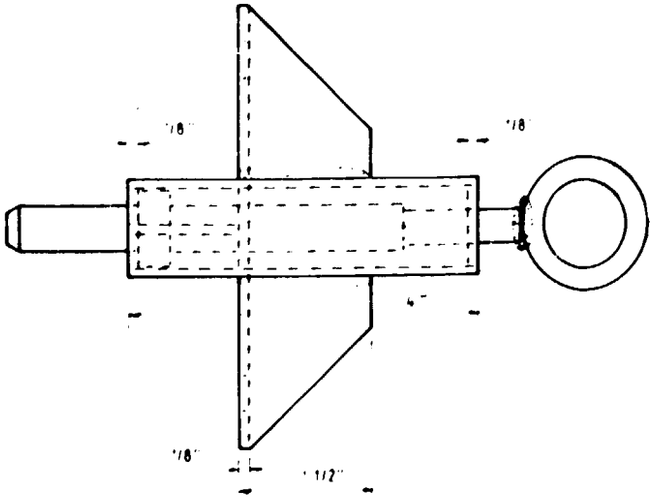


NOTE
Edges of chute parts are marked for mating
Mat'l 10 body steel
Scale 3"= 1'-0"

B4
CHUTE BOTTOM
1 Req

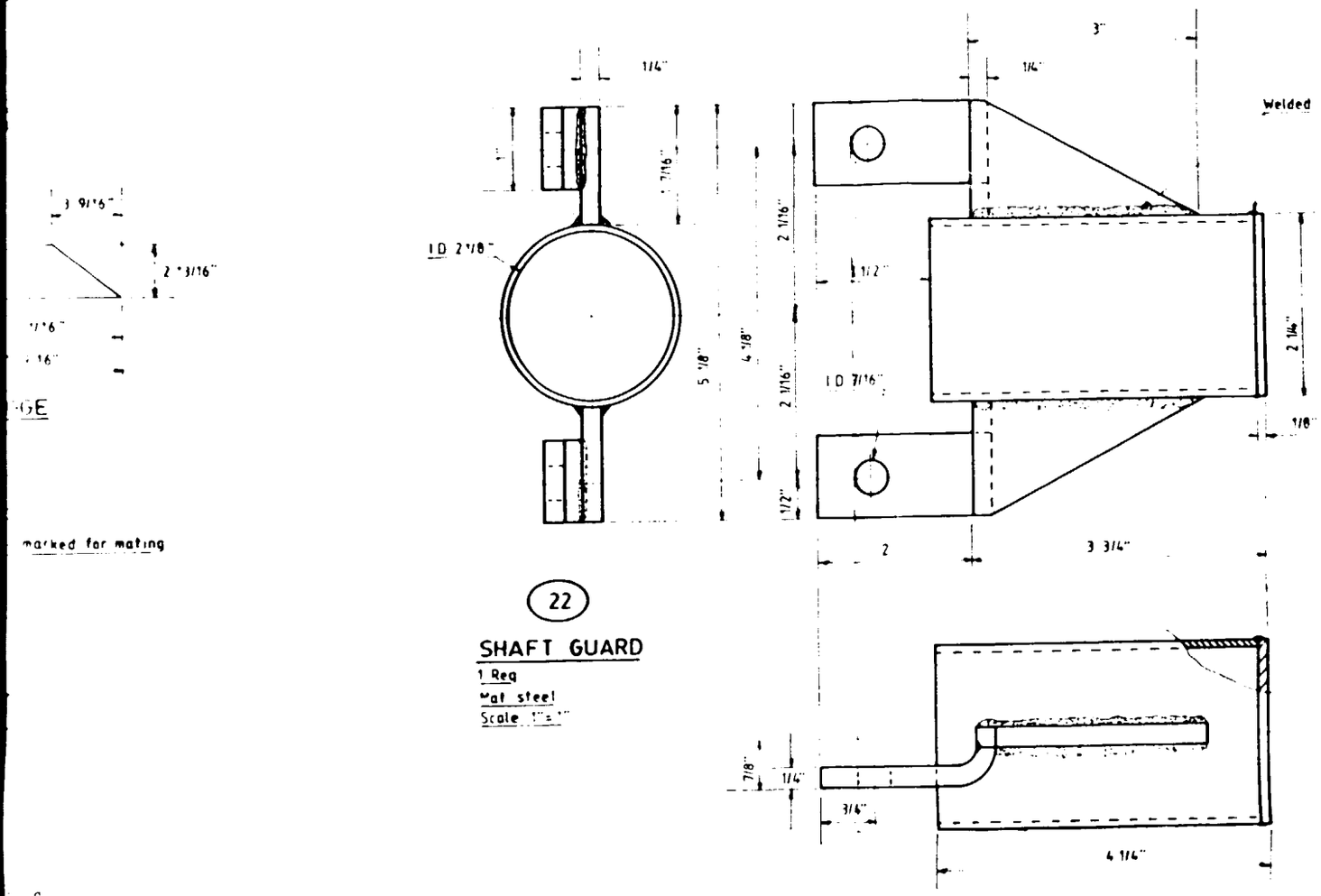






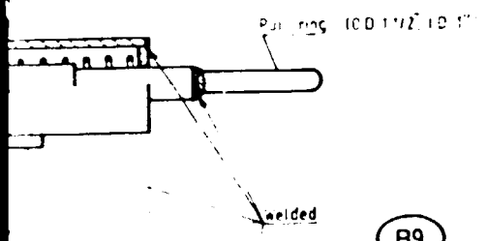
B9 LOCKING
Mat steel
1 Req
Scale 1"

SECTION 1



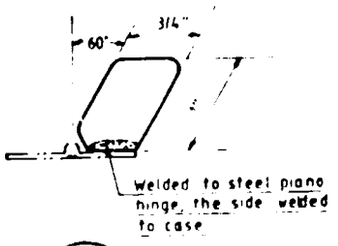
22 SHAFT GUARD

1 Req
Mat steel
Scale 1"= 1"



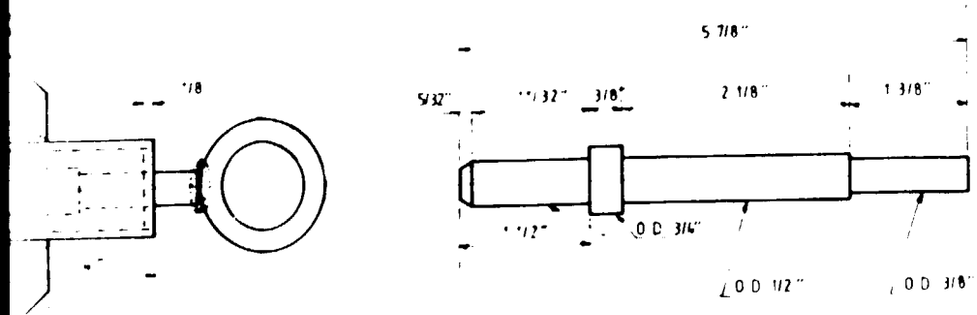
B9 LOCKING PIN & BRACKET

Mat steel
1 Req
Scale 1"= 1"



14 HINGE TOP STOP

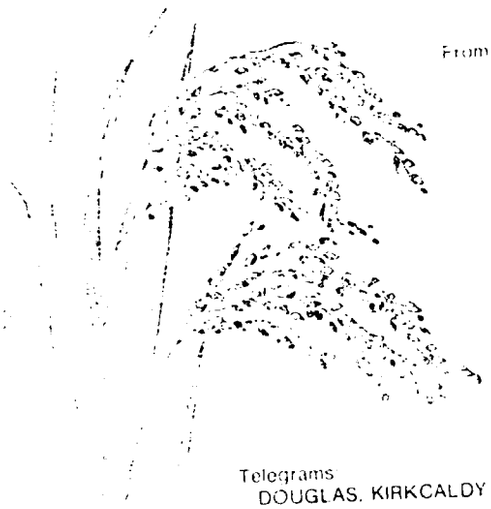
Mat 1/4" steel
1 Req
Scale 1"= 1"



10x12 GRAIN DEHULLER

Sheet 7 of
1/2" = 1" Revised

SECTION 2



From

LEWIS C. GRANT LTD.

MANUFACTURERS OF

REGISTERED GRANTEX TRADE MARK

Rice Milling Machinery,
Grain Dryers

EAST QUALITY STREET,
DYSART, KIRKCALDY
FIFE KY1 2UA, SCOTLAND

Telegrams
DOUGLAS, KIRKCALDY

Telephone
KIRKCALDY 51035/6

16th December 19 82

Your Ref:

Our Ref:
JW/WMC

MM. SOFRECO,
24 Rue Murillo,
75008 PARIS,
France.

21 DEC 1982

Your Ref.C134/CUN/KIM/L/2525

Dear Sirs,

We thank you for your letter of 30th November and have pleasure in enclosing a leaflet on our rice hullers (equivelant of type 1A).

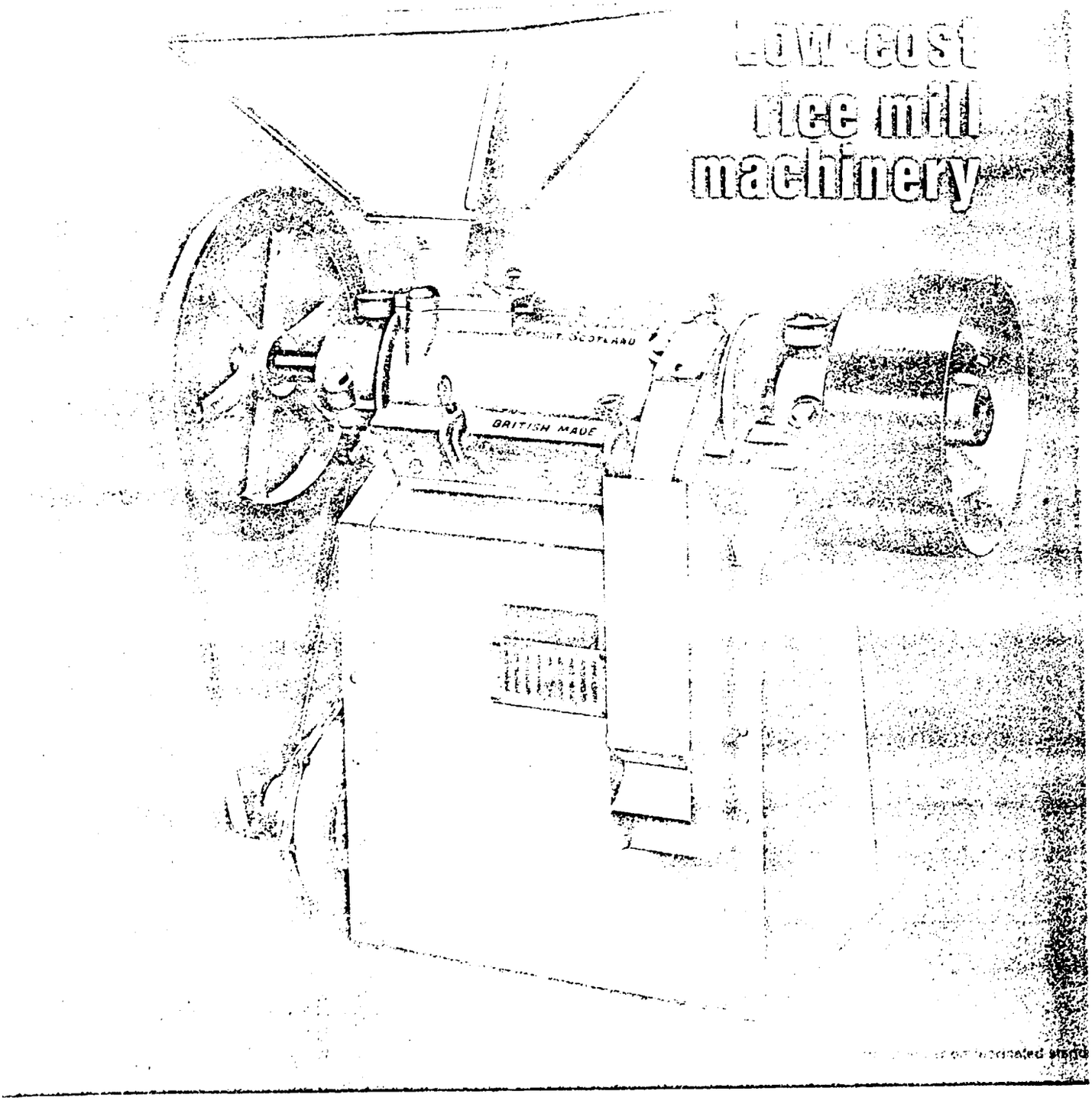
Unfor tunately, we have no experience of processing millet and sorghum.

Assuring you of our best attention.

Yours faithfully,
For LEWIS C. GRANT LTD.

J. Walker
Export Manager.

Encl.
Leaflet Q23

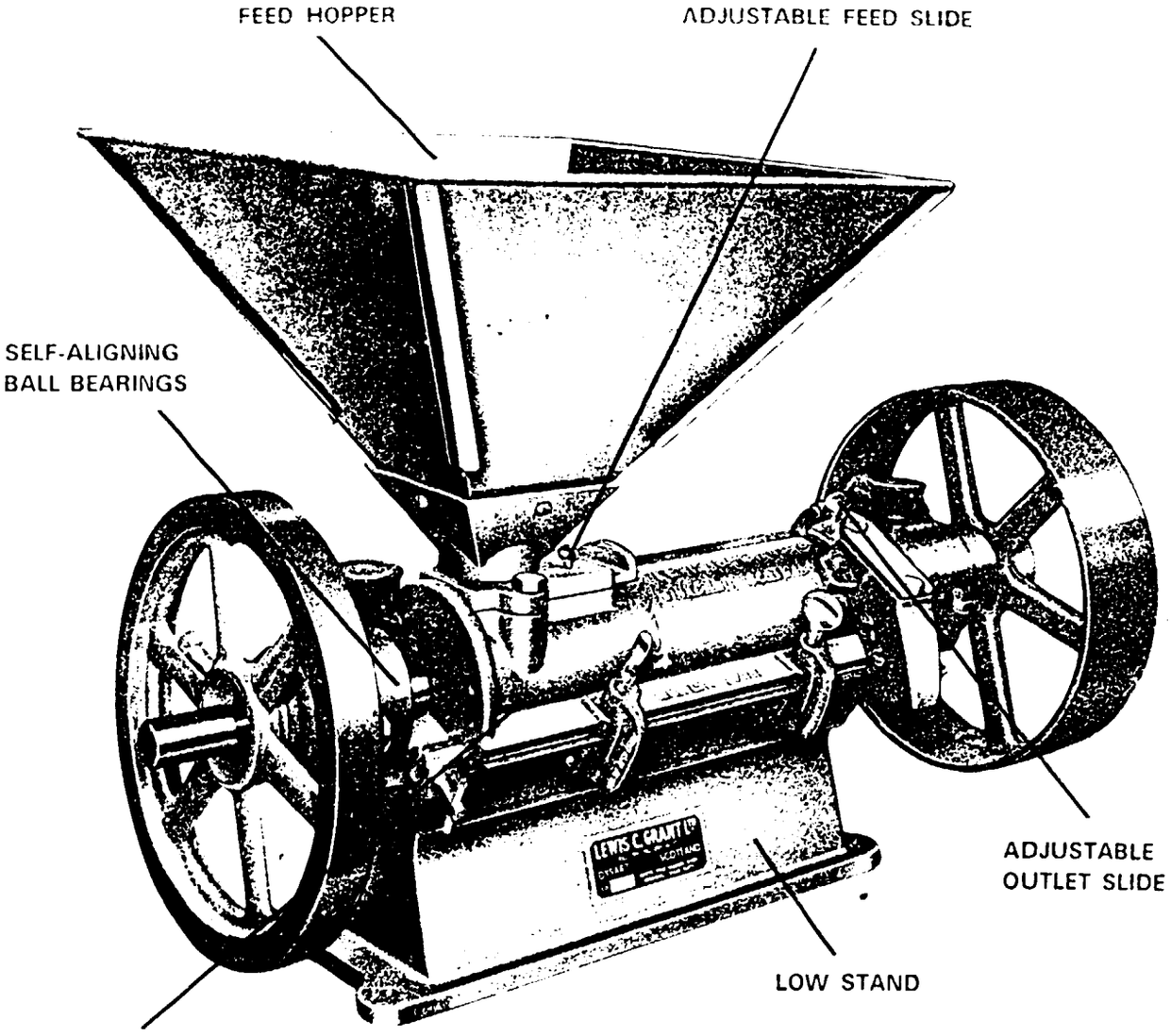


GRANTBX

Registered Trademark

RICE HULLERS

Hullers · Polishers · Combines



No. 8 Huller on low stand with single pulley

Features of Grantex Rice Hullers

GENERAL

GRANTEX Rice Hullers are low-cost, ball-bearing machines for the preparation of edible rice. They will shell paddy and whiten rice in one operation in a single machine. They can also be used at double the capacity to whiten only, in more elaborate installations where separate machines shell and aspirate the paddy.

GRANTEX Rice Hullers are easy to operate and maintain. Spare parts are readily available and replacement requires no special skill. Full operating instructions, together with installation drawings and spare parts lists, are packed with each machine.

OPERATION

To perform the shelling and or whitening process, a specially chilled, hard cast iron cylinder is rotated inside a hardened screen.

The degree of milling is controlled by

(a) The Outlet Slide, which regulates the time the rice remains in the machine.

(b) The Huller Blade, which regulates the severity of the process and is adjustable, to suit the variety and condition of the rice being milled, to keep breakage to a minimum.

SIZES AVAILABLE

Three sizes of GRANTEX Rice Hullers are made

Size 2 230/290 kilos of rice from paddy

Size 4 35/45 kilos of rice from paddy

Size 8 140/200 kilos of rice from paddy

The addition of a polisher section is denoted by Model Nos. 1, 3 or 7

Sizes and Specifications

Huller Size	Capacity Kgs of polished rice per hour / Lbs of polished rice per hour — From Paddy	From Shelled Rice	Power hp	Speed rpm	Drive Pulley Size (mm/ inches) Dia. Width Bore	Models Available No.	Type	Approx. Shipping Specifications in Tonnes — Machine	Accessories Available: Fan	Fan and Aspirator	Fast and Loose Pulleys	Belt Guards
2	230/290	450/590	15	750	317 x 140 x 40	1	Polisher	0·63	★	★	0·12	0·07
						2	Low Stand	0·27	N/A	N/A	0·04	0·04
						2	High Stand	0·41	N/A	★	0·07	★
	500/650	1000/1300			12½ x 5½ x 1½	2	Fabricated Stand	0·49	★	Included	0·07	★
						2C	Combine	1·35	Included	Included	Included	0·10
4	35/45	70/90	5	900	203 x 76 x 25	3	Polisher	0·26	★	★	0·06	0·09
						4	Low Stand	0·09	N/A	N/A	0·02	0·02
	80/100	160/200			8 x 3 x 1	4	High Stand	0·12	N/A	★	0·04	0·03
8	140/200	270/360	12	900	356 x 102 x 35	7	Polisher	0·43	★	★	0·07	0·04
						8	Low Stand	0·27	N/A	N/A	0·03	0·02
	300/450	600/800			14 x 4 x 1¼	8	High Stand	0·33	N/A	★	0·03	0·03
						8C	Combine	1·29	Included	Included	Included	0·10

N.B —A No. 2, 4 or 8 Huller with the addition of a Polisher becomes Model No. 1, 3 or 7. The addition of a Polisher does not increase the hourly capacity.

N/A not available ★ no additional tonnage

NOTE ON MOTORS FOR MILLS AND DEHULLERS

This note is annexed to the present study because it does not concern directly the unit of production of mills and dehullers. Some of its basic information are taken from the study GCP/RAF/045 made by Mr K. V. VANEK whose study made for the F.A.O. (2nd report on August 1981 and June 1982), treats particularly the subject of power consumption of small mills and dehullers.

In this study, tests give the following consumptions :

1) For mills :

a) Wet milling :

Product	Flow-rate Kg/h	Granulometry	Power consumption
Sorghum	266 to 365	1,13 to 1,40	47 to 68
Millet	278 to 301	1,19 to 1,28	52 to 61

b) Dry milling :

Product	Flow-rate Kg/h	Granulometry	Power consumption
Sorghum	172 to 291	1,96 to 2	58 to 68
Millet	247 to 301	1,76 to 1,97	54 to 61

2) For dehullers :

a) FAO type dehullers :

Product	Flow-rate Kg/h	Yield	Power consumption KJ/kg
Sorghum	204	78	93
Millet	173 à 275	77 à 79	77 à 89

b) PRL/IDRC type dehullers :

Product	Flow-rate Kg/h	Yield	Power consumption KJ/kg
Sorghum Millet	300	75 à 85	63

c) Tests on few "Engleberg" type dehullers :

Product	Flow-rate Kg/h	Yield	Power consumption KJ/kg
Sorghum	113 à 304	69 à 73	102 à 145
Millet	115 à 230	64 à 71	100 à 119

CALCULATION AND CHOICE OF THE POWER FOR MOTOR FOR MILLS :

On charts 1 -a and 1-b, we shall take the more unfavorable case corresponding to a consumption of 68 KJ/kg product. For a grinding mill of 200 kg/h flow-rate, power consumption will be 13.600 KJ/h, corresponding to a 3,7 kw effective power. Considering an yield of 0,85 for the electrical motor and an utilization ratio of 0,8; the plant factor will be 0,68 and the installed capacity will be about 5,4 kw (7,3 HP).

It is necessary to compare this installed capacity with the manufacturers' informations.

	Speed RPM	Flow-rate Kg/h	Motor Horse Power
Bentall Superb	600	227/272	5
Hunt 1 A	550/650	180	4 à 5
Hunt 2 A	550/650	270	6 à 7
Champenois CLB	500/1000	60/200	3,5 à 7

We shall take :

- Electric motor : 1.500 RPM, 7 H.P. rating.
- Thermal engine : 650/750 RPM, 10 H. P. rating.

CHOICE OF THE POWER FOR MOTOR FOR DEHULLERS :

A market study for the next years should allow us to determine the most appropriate IDRC equipment. We think that the PRL Mini-dehuller with a 5 kg minimum flow-rate should be included in this choice.

In this case, horse power rating, taking into consideration tests made in the Republic of MALI and the IDRC preconizations, could be :

. Electric motor : 3 H.P.
. Thermal engine : 5 H.P.

CONCLUSIONS :

The range of horse power rating could be : 3 - 5 - 7 - 10 H.P.; 3 and 7 H.P. for electric motors; 5 and 10 H.P. for thermal engines.

Generally, electric motors are the cheaper source of mecanical power, followed by diesel engines at low power load, 600 - 800 RPM, with water cooling and at last thermal engines at high power load with air cooling; Thermal engines last less than the others (pratically the half).

A thermal motor must work at 80 - 90° C to have a good yield and therefore a minimum fuel consumption. For that, it is necessary to work in continuous process, but, it requires a good organization of the miller. This disadvantage does not appear with electric motor, (the rating is fast).

Presently, the choice of the type of motor is not a problem in the country because of the very small availability of electric power plants.

Dated: 21 December 1981

TERMS OF REFERENCE

A. General Background Information

Millet and sorghum are the staple food of the populations of Nigeria and Niger situated in the Sahel zone. The traditional tedious method of pounding the grain by women is still prevailing. The study by UNIDO on millet and sorghum flour milling (project RAF/77/801) recommended the establishment of industrial mills for the specific production of millet and sorghum flour in selected urban centres. As a follow-up, a pre-feasibility study will be carried out shortly, also under the auspices of the Nigeria-Niger Joint Commission for Cooperation, on the setting up of three pilot mills, of which one in Niger and two in Nigeria.

Simultaneously, the UNIDO study mentioned above recognised the spontaneous trend of replacing, in rural areas, the pounding of millet and sorghum by women, by small village mills with a capacity of about 20 Kg per hour.

The magnitude of the problem is highlighted by the fact that 90 per cent of the population of Niger, and 70 to 80 per cent of the population of Nigeria, live in rural areas. It is not conceivable to have them supplied by millet and sorghum semolina and flour from large industrial mills located in a small number of towns, due to lack of distribution channels and very high transport costs.

The recommended village mills, consisting of a diesel engine and of a decorticator and a grinder, have a capacity which covers the needs of 300 to 500 families. Their technology must be adapted to the specific properties of millet and sorghum.

As far as the present status is concerned, between 20 and 30 per cent of the required quantity are already installed in Nigeria, whereas only a few such installations exist in several larger towns in Niger, and none in villages.

However, the small mills presently in use have been generally chosen in a haphazard way. They work in poor conditions and most

often the major part of the nutritional value of the grains treated gets destroyed which was not the case with the old method of pounding by hand.

To satisfy the actual need of the rural areas of Nigeria and Niger, from 8,000 to 10,000 village mills ought to be introduced throughout the two countries during this decade.

With this very realistic target in view, it is desirable to consider setting up local manufacturing of village mills and to introduce theiruse on a large scale in rural areas throughout the region. It would contribute to the achievement of the following policy objectives declared in the national development plans of both member countries of the Nigeria-Niger Joint Commission for Cooperation:

1. Rural development through the establishment of small scale industrial units in rural communities;
2. The creation of employment in rural areas, thus putting brakes on the rural exodus and on the drift to urban areas (it is estimated that about 20,000 jobs may be created in this way in this decade);
3. The liberation of women from the tedious job of pounding, in favour of other productive activities;
4. The introduction of a technology appropriate for the specific conditions of the rural areas in the Sahel zone;
5. The decentralization of industrial development generating important savings on storage and transport costs and contributing to the stabilization of prices;
6. Foreign exchange savings by import substitution.

For all those reasons, a pre-feasibility study on manufacturing of village mills for millet and sorghum, covering the relevant territories of Niger and Nigeria, will be carried out on behalf of the Nigeria-Niger Joint Commission for Cooperation.

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B. The Aim of the Project

The aim of the Project is a pre-feasibility study which will investigate the following main issues:

a) to survey the present situation in comparison with the assessment of the actual needs and the potential market for village mills;

b) to recommend the appropriate type of grinder/decorticators and of engines to be manufactured;

c) to determine the production programme and capacity of the plant to be set up, the technology to be used, the appropriate distribution channels including promotional policies, and the organization of maintenance;

d) to recommend the optimum location of the plant;

e) to determine the manpower requirements and the appropriate training schemes; and

f) to make a thorough financial analysis of the project and its national socio-economic evaluation in respect of both countries and of strengthening their mutual cooperation.

In case the findings of the pre-feasibility study are positive and its recommendations are adopted by the Council of Ministers of the Nigeria-Niger Joint Commission for Cooperation, a full-fledged techno-economic feasibility study will be undertaken to be followed by the implementation of the project.

C. The Scope of Contracting Services

The contract work will consist of the following components:

1. Market study covering Niger and Nigeria, investigating in particular:

a) the present supply (sources, costs, problems of maintenance, operational efficiency);

b) the needs and the potential market within the next ten years, including replacement and spare parts;

c) the export potential to neighbouring countries if any (a rough estimate only).

2. Technology

This item will contain:

a) a recommendation concerning the most appropriate type of grinders/decorticators specifically designed for millet and sorghum, after evaluating, among others, the technology developed by the International Development Research Centre of Ottawa, Canada and tested in Nigeria in 1978;

b) an indication on the capacity, the simplicity of construction and of maintenance, the production costs and the operating costs of the selected type, in comparison with the other existing and investigated types;

c) a recommendation on the type of engine best suited to run the selected grinder/decorticator, after considering alternative power sources such as diesel and electric motors and annual and wind-powered transmission systems;

d) a recommendation on the type of contract on the transfer of technology to be concluded by the prospective investor.

3. Production programme

This item will contain:

a) an investigation on the possibility and desirability of combining the production of grinder/decorticators with other foundry products such as groundnut decorticators or centrifugal pumps for irrigation purposes, the latter in view of the large irrigation programmes planned by both Gouvernments;

b) an assessment of the feasibility of manufacturing diesel engines to complement the grinder/decorticator either in some already existing plant, if any, or in a plant to be set up; this again whether as a separate unit or as a component of the plant which will manufacture the village mills;

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c) a recommendation on the exact products to be manufactured and on their respective quantities and properties;

d) the identification of potential manufacturers, if any, or the recommendation to set up a new plant.

4. Material inputs

A detailed description will be given of the inputs of raw materials, intermediate goods and energy required for the recommended production programme, and whether they may be of local provenance or would have to be imported. An indication of the costs will be given in each case. A realistic manufacturing programme should be developed for a gradual switch from assembly of bought - in components to manufacturing components.

5. Plant capacity and technology

This item will contain:

a) a determination of whether the plant should operate in one shift or in more shifts;

b) a rough lay-out of the proposed equipment and an estimate of its investment cost;

c) a rough lay-out of the civil engineering works and an estimate of its investment cost;

d) a schedule of the plant organization and an estimate of the operating costs.

6. Manpower

An assessment will be given of the manpower requirements by categories and shifts, of the labour costs, as well as of the training requirements.

7. Location and site

Several alternative locations will be investigated, particularly on the basis of a comparative analysis of the suitability of potential existing manufacturers if any, of the transport costs of the inputs and outputs, of the available infrastructure including utilities (supply of fuel, power and water), and of the

availability of labour. A firm recommendation will be made on the most advantageous location and site.

8. Implementation scheduling and costs

A tentative time schedule for the implementation of the project will be provided, as well as the costing of its individual phases.

9. Marketing and promotion

After an assessment of the present status and of the specific requirements of the project, recommendations will be made:

a) on the distribution channels appropriate for getting the products to the villages throughout the whole region;

b) on the organization of maintenance and after-sale services;

c) on the promotional measures to be adopted by the two Governments on their respective territories, such as extension services, specific credit facilities and other measures conducive to the broadest implantation of village mills throughout the rural areas;

d) on specific measures such as waiving of custom duties, to be adopted jointly by the two Governments.

10. Financial analysis

This item will contain:

a) a detailed determination of the investment costs, including working capital and pre-investment costs;

b) a recommendation on the financing of the project;

c) an estimate of the production costs;

d) an estimate of the sales revenues;

e) projected cash flow profit and low account and balance sheet tables

f) a global financial evaluation of the project, including the pay-off period and the

..... [illegible] Guidelines for the Preparation of Industrial Feasibility Studies for Consulting Firms gives fuller details of points 1 - 10 above, and should be followed.

11. National economic evaluation

The project will be evaluated from the points of view of its national economic and social profitability in respect of both countries, and of strengthening their mutual cooperation.

D. General Time Schedule

The Contractor will keep the following time schedule:

(i) The Team Leader will visit UNIDO for briefing within two weeks after the signature of the contract.

(ii) The Contractor's personnel will arrive in the project area within two weeks after the Team Leader's briefing.

(iii) The work in the project area will be implemented in approximately two months, representing about four man/months.

(iv) At the end of the work in the project area, the Contractor's team will make a preliminary oral report on their main findings and conclusions to the Secretary-General of the Nigeria-Niger Joint Commission for Cooperation.

(v) On the return from the project area, the Team Leader will visit UNIDO for debriefing.

(vi) The Contractor will submit the Draft Final Report to UNIDO within six weeks at the latest, after the return of his team from the project area.

(vii) UNIDO shall comment on the Draft Final Report within two weeks thereafter.

(viii) UNIDO shall receive the Final Report within one month after having sent its comments.

E. Personnel in the Field

The Contractor's team in the field will consist of at least two specialists, viz., a mechanical engineer with a large experience in establishing and/or operating foundries or mechanical shops;

and an industrial economist with experience in market studies and financial analysis of projects. Both should have a practical knowledge of developing countries. The Nigeria-Niger Joint Commission for Cooperation will arrange for the Contractor's team the required contacts with and available information from, the relevant national and local authorities and institutions, as well as international organizations working on related technical assistance projects in the area.

F. Language Requirements

The working languages of the Contractor's field personnel will be English and French. They should have a full knowledge of at least one of those languages and the capacity to work in the other language.

G. Reports

The Contractor will submit to UNIDO, in line with the time schedule indicated under D. above, a Draft Final Report in English or French, in ten (10) copies out of which two copies for the Nigeria-Niger Joint Commission; and the Final Report in English and French, in fifty (50) copies, out of which the Nigeria-Niger Joint Commission for Cooperation will require to obtain 35 copies in each of the two languages.

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